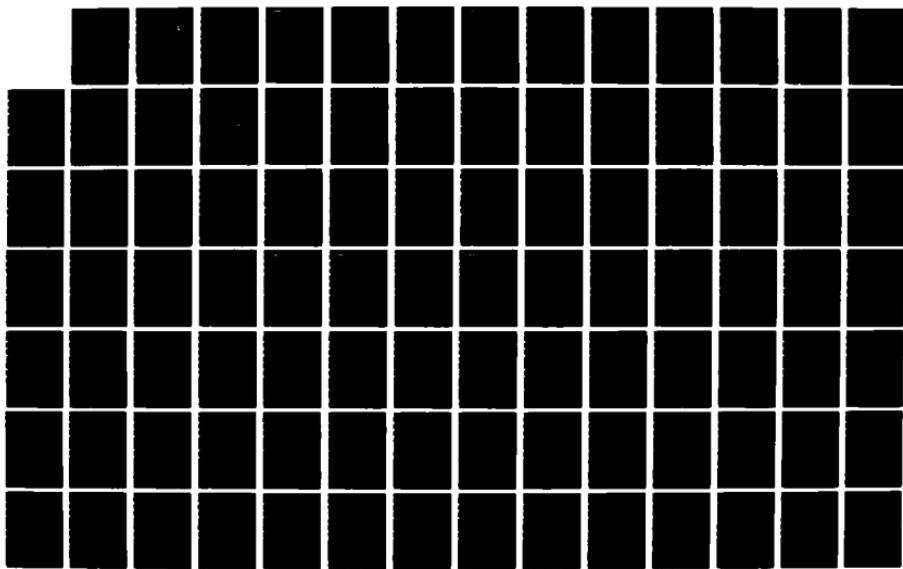


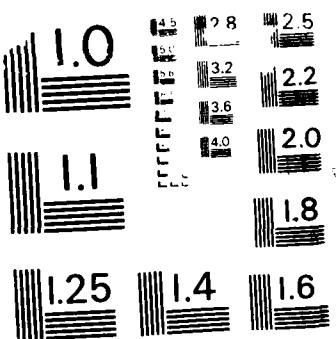
AD-R198 448 INSTALLATION RESTORATION PROGRAM PHASE 2
CONFIRMATION/QUANTIFICATION STAG (U) RADIAN CORP
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INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT
FOR
AIR FORCE PLANT 4
FORT WORTH, TEXAS

VOLUME 8. APPENDICES B-E

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SELECTED
S FEB 04 1988 D

HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION
FACILITIES MANAGEMENT DIVISION (ASD/PMDA)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6503

AND

HEADQUARTERS, AIR FORCE SYSTEMS COMMAND
COMMAND BIOENVIRONMENTAL ENGINEER (AFSC/SGPB)
ANDREWS AIR FORCE BASE, DC 20334-5000

DECEMBER 1987

PREPARED BY
RADIAN CORPORATION
8501 MO-PAC BOULEVARD
POST OFFICE BOX 201088
AUSTIN, TEXAS 78720-1088

USAF CONTRACT NO. F33615-83-D-4001 DELIVERY ORDER 27
RADIAN CONTRACT NO. 212-027-27

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

USAFOEHL TECHNICAL PROGRAM MANAGERS
MAJOR GEORGE R. NEW
CAPTAIN ARTHUR S. KAMINSKI

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

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NOTICE

This report has been prepared for the United States Air Force by Radian Corporation, for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

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Well Completion Logs.....	E-67



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APPENDIX B

Definitions, Nomenclatures, and Units



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- o AA - atomic absorption.
- o AFB - Air Force Base.
- o AFESC - Air Force Engineering and Services Center.
- o Alluvium - stream deposited sediment, predominantly clay, silt, sand and gravel.
- o Aquifer - geologic unit capable of storing and transmitting significant quantities of water.
- o Artesian - term applied to groundwater confined under hydrostatic pressure.
- o BGL - Below Ground Level
- o C - field conductivity (specific conductance).
- o °C - degrees centigrade (Celsius).
- o Caliche - calcareous material of secondary origin commonly occurring as near surface layers in arid to semi-arid climates.
- o CE - Civil Engineering.
- o Confined Aquifer - an aquifer containing groundwater under sufficient pressure to rise above the level at which it is encountered by a well.
- o Craton - a part of the Earth's crust (continental areas) which has attained stability, and which has been little deformed for a prolonged period.
- o DOD - Department of Defense.
- o DPDO - Defense Property Disposal Office.
- o Drawdown - the lowering of the water level in a well or well field as a result of withdrawal.
- o EPA - U.S. Environmental Protection Agency.
- o EPA Method 413.2 - IR method for determining oil and grease concentrations.
- o EPA Method 415.1 - IR method for determining total organic carbon.
- o EPA Methods 601 and 602 - GC methods for determining chlorinated hydrocarbons (601) and aromatic hydrocarbons (602) in water samples.

- o EP Toxicity - EPA Method 7310 for determination of hazardousness by the criterion of toxicity.
- o Extraction - method for mobilizing contaminant species from a solid matrix prior to analysis.
- o °F - degrees Fahrenheit.
- o FDTA - Fire Department Training Area.
- o GC - gas chromatography.
- o HARM - Hazard Assessment Rating Methodology.
- o Hazardous Waste - waste determined to be hazardous by virtue of toxicity, reactivity, ignitability, or corrosivity criteria.
- o HM - Hargis & Montgomery
- o H₂SO₄ - sulfuric acid.
- o IR - infrared.
- o IRP - Installation Restoration Program.
- o JP-4 - jet fuel used by Air Force.
- o mg/L - milligrams per liter.
- o ug/g - micrograms per gram.
- o ug/L - micrograms per liter.
- o umhos - micromhos (a measure of specific conductance).
- o Marl - A soft, semi-friable, unconsolidated deposit, consisting chiefly of a mixture of clay and calcium carbonate.
- o MCL - Maximum Contaminant Level.
- o MSL - mean sea level.
- o NARF - Nuclear Aerospace Research Facility.
- o OEHL - Occupational and Environmental Health Laboratory.
- o O&G - oil and grease.
- o PCB - polychlorinated biphenyls.
- o POL - petroleum, oil and lubricants.

- o ppb - parts per billion (ug/L).
- o ppm - parts per million (mg/L or ug/g).
- o PVC - polyvinyl chloride.
- o piezometric/potentiometric surface - an imaginary surface representing the static head of groundwater and defined by the level to which water will rise in a well.
- o P4 - U.S. Air Force Plant No. 4
- o QA/QC - Quality Assurance/Quality Control.
- o RAS - Radian Analytical Services.
- o RCRA - Resource Conservation and Recovery Act.
- o RMCL - Recommended Maximum Contaminant Level.
- o SCS - Soil Conservation Service.
- o Spike - the known amount of a compound added to a sample to determine the accuracy of analysis.
- o Standard Methods 509A and 509B - GC methods for identifying pesticides.
- o SW 8010 and 8020 - GC methods for determining chlorinated hydrocarbons (8010) and aromatic hydrocarbons (8020) in soils.
- o TAC - Tactical Air Command.
- o transmissivity - in an aquifer, the rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient.
- o TDS - total dissolved solids.
- o TOC - total organic carbon.
- o USAF - United States Air Force.
- o USAFOEHL - United States Air Force Occupational and Environmental Health Laboratory.
- o USDA - United States Department of Agriculture.
- o USGS - United States Geological Survey.
- o VOCs - Volatile Organic Compounds
- o Water Table - the elevation of the groundwater surface in an unconfined aquifer.



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APPENDIX C

Statement of Work

ORDER FOR SUPPLIES OR SERVICES

2. PROC INSTRUMENT ID NO. (P.I.I.N.)				3. CALL/ORDER NO.	4. DATE OF ORDER*	5. REQUISITION/PURCHASE REQUEST PROJECT NO.	PAGE 1 OF 28
F33615-83-D-4001				0027	85SEP13	FY7624-85-01116	6. CERTIFIED FOR NATIONAL DEFENSE UNDER DO-S1 MDC REG 2/DMS REG 1 PAY RD
Mark all packages & papers with this number							
7. ISSUED BY CODE F08419				8. ADMINISTERED BY CODE S4404A			
DEPARTMENT OF THE AIR FORCE AIR FORCE SYSTEMS COMMAND AERONAUTICAL SYSTEMS DIV/PMRSC WRIGHT-PATTERSON AFB OH 45433-6503 CONTRACT NEGOTIATOR: CONNIE SNYDER PHONE: (513)-255-3042				DCASMA SAN ANTONIO 615 EAST HOUSTON ST. P.O. BOX 1040 SAN ANTONIO TX 78294-1040			
9. CONTRACTOR NAME AND ADDRESS CODE 29913				10. MAIL INVOICES TO			
RADIAN CORPORATION 8501 MO-PAC BLVD P. O. BOX 9948 AUSTIN TX 78766				MAILING DATE SEE SECT "G"			
PHONE: (512)-454-4797 COUNTY: TRAVIS				11. DISCOUNT FOR PROMPT PAYMENT NET D ST N % DAYS Z ND % DAYS NO % DAYS OTHER SEE SECT "B"			
12A. PURCHASE OFFICE POINT OF CONTACT LNO/L58/LNO				13. PAYMENT WILL BE MADE BY CODE S4403A IF "9" SEE SECT "G" DCASR DALLAS 500 SOUTH ERVAY ST. DALLAS TX 75201-6377			
12B. RESERVED FOR SERVICE/AGENCY USE							
14. TYPE CONTRACTOR		15. SECURITY		16. CONTRACT ADMINISTRATION DATA			
A		U		A. CLAS	B. DATE OF DD 254	E. CONT ADMIN FUNC LMT	17. (RESERVED)
18. CONTRACT PAY (1) KIND (2) TYPE		19. ABSTRACT RECIP D. SPL CONT PROVISIONS		18. SVC/AGENCY USE			
0 9		ADP POINT		19. SURV CRIT			
21. APPROPRIATION AND ACCOUNTING DATA A. ACTY B. ACRN C. APPROPRIATION U AA 9750810 0200				20. TOTAL AMOUNT NOT-TO-EXCEED C 493,313.20			
D. LIMIT SUBHEAD				E. SUPPLEMENTAL ACCOUNTING CLASSIFICATION E75 4308 P82000 000000 00000 000000 503701			
F. CPM RECIPIENT DODDG FO3701				H. NON-CLIN/ELIN PAYMENT PROV FY7624-85-01116 **			
G. OBLIGATION AMOUNT \$493,313.20							
22A. DELIVERY X TYPE OF PURCHASE				B. NON-DOD CONTRACT NO. This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.			
				CONTRACT CATEGORY CODE: FAZ			
Furnish the following on forms specified herein, including, for U.S. purchases, General Provisions of Purchase Order in GPO Form 1155r, EXCEPT CLAUSE 13, APPLIES ONLY IF THIS FORM IS CHECKED AND NO. 15 IF THIS FORM IS CHECKED, special provisions _____ and delivery as indicated. This purchase is regulated under authority of 10 USC 2304(a)(1) or as specified in the schedule if within the U.S., its possessions or Puerto Rico, if otherwise, under 2304(a)(6).							
If checked, Additional General Provisions apply. Supply shall be Acceptance on DD Form 1155r and return				23. SIGNATURE OF CONTRACTING OFFICER AND DATE CHRISTOPHER D. MILLER BY NAME OF CONTRACTING/ORDERING OFFICER AND DATE CHRISTOPHER D. MILLER 8-20-85 24. TOTAL 25. QUANTITY ORDERED HAS BEEN INSPECTED RECEIVED ACCEPTED AND CONFORMS TO THE CONTRACT EXCEPT AS STATED 26. SHIP NO. 27. D.O. VOUCHER NO. 28. DIFFERENCES INITIALS			
28. DIFFERENCES INITIALS				29. AMOUNT VERIFIED CORRECT FOR 30. PAYMENT PARTIAL FINAL 31. PAID BY PARTIAL FINAL			
32. CHECK NUMBER				33. BILL OF LADING NO.			
34. BILL OF LADING NO.				35. CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT SIGNATURE AND TITLE OF CERTIFYING OFFICER			
36. RECEIVED AT 37. RECEIVED BY				38. DATE RECEIVED 39. TOTAL CONTAINERS 40. S.R. ACCOUNT NUMBER 41. S.R. VOUCHER NO.			

PREVIOUS EDITION IS OBSOLETE.

**When used as a formal contract this will be the exclusive basis for all claims.*

6-2

**1947 HSG/V

1947 MSG/PACF, AF FORM 402, PENTAGON,
WASHINGTON DC 20330-6010, E7-OA85-3, CH 3, 26 JUN 85

PART I SECTION B OF THE SCHEDULE SUPPLIES LINE ITEM DATA				1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIN	3.
4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	F33615-83-D-4001	0027	PAGE 2 OF 28
0001	1	SE	\$N			
9. SCTY 10. ACRN 11. NSN CLAS	12. FSCM AND PART NUMBER					13. CIRR
U AA N						
14. SITE CODES A.PO A.CP C.PO	15. MOUN					
D D D	AIR SAMPLING, ANALYSIS AND DATA					
17. PR/MIPR DATA FY7624-85-01116-0001	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUR	19. CONTRACT PERCENT FEE	20. SVC ID NO.	21. ITEM/PROJ MGR		
22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET B.DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT	28. OPR Y
%	%	%	%	%		
29. DESCRIPTIVE DATA						

CONDUCT WORK IAW THE TASK DESCRIPTION (PAGES 4 TO 27 HEREOF) AND SECTION C, DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT# 1 , THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*	
0002	1	SE	\$N	N	
9. SCTY 10. ACRN 11. NSN CLAS	12. FSCM AND PART NUMBER				13. CIRR
U AA N					
14. SITE CODES A.PO A.CP C.PO	15. MOUN				
D D D	SUPPORT				
17. PR/MIPR DATA FY7624-85-01116-0002	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUR	19. CONTRACT PERCENT FEE	20. SVC ID NO.	21. ITEM/PROJ MGR	
22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET B.DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT
%	%	%	%	%	Y
29. DESCRIPTIVE DATA					

SUPPORT FOR ITEM 0001

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO
 N = NOT APPLICABLE
 E = ESTIMATED
 U = UNDEFINITIZED
 'NSP = NOT SEPARATELY PRICED
 - (IN QTY AND \$) = DECREASE
 + OR - (IN ITEM NO.) = ADDITION OR DELETION
 CIRR = CONTROLLED ITEM RPT RQMT

C-3

SITE CODES
 S = SOURCE
 D = DESTINATION
 O = INTERMEDIATE

PART I SECTION B OF THE SCHEDULE SUPPLIES LINE ITEM DATA				1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIN	3. PAGE 3 OF 28
4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*		
0004	1	SE	\$ N	\$ N		
9. SCTY10.ACRN CLAS	11. NSN	12. FSCM AND PART NUMBER				13. CIRR
U AA N						
14. SITE CODES A.PQA B.ACQ C.FOB	15. HOUR					16. SVC/AGENCY USE
D D D	CHEM/PHYS ANALYSIS AND DATA					
17. PR/MIPR DATA	FY7624-85-01116-0004	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUR				19. CONTRACT 20. SVC ID NO. 21. ITEM/PROJ MGR
22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET B.DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT 28. OPR J	
%	%	%	%	%	%	
29. DESCRIPTIVE DATA						
PERFORM CHEMICAL TESTS IN ACCORDANCE WITH DESCRIPTION OF TASK SET FORTH IN PAGES 4 THROUGH 27 HEREIN, AND DELIVER DATA IN ACCORDANCE WITH ATTACHMENT #1, DD FORM 1423 OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI, PAGE 19 HEREIN.						
4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*		
9. SCTY10.ACRN CLAS	11. NSN	12. FSCM AND PART NUMBER				13. CIRR
14. SITE CODES A.PQA B.ACQ C.FOB	15. HOUR					16. SVC/AGENCY USE
17. PR/MIPR DATA	FY7624-85-01116-0004	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUR				19. CONTRACT 20. SVC ID NO. 21. ITEM/PROJ MGR
22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET B.DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT 28. OPR J	
%	%	%	%	%	%	
29. DESCRIPTIVE DATA						

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO

N = NOT APPLICABLE

U = UNDEFINITIZED

NSP = NOT SEPARATELY PRICED

E = ESTIMATED

- (IN QTY AND \$) = DECREASE

+ OR - (IN ITEM NO) = ADDITION OR DELETION

CIRR: CONTROLLED ITEM RPT RQMT

S = SOURCE
D = DESTINATION
O = INTERMEDIATE
SITE CODES:

RECEIPT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 28

1. CONTRACT NO. (P.I.I.N.) E33615-83-D-4001	2. SPIN 002702	3. EFFECTIVE DATE 86JUN06	4. REQUISITION/PURCHASE REQUEST PROJECT NO. FY6624-86-01004	5. BDC/DMS RATING
6. ISSUED BY DEPARTMENT OF THE AIR FORCE AIR FORCE SYSTEMS COMMAND AERONAUTICAL SYSTEMS DIV/PMRSC WRIGHT-PATTERSON AFB, OH 45433-6503 NEGOTIATOR: 1LT GLENNITH C. JOHNSON PHONE: (513) 255-3042		7. ADMINISTERED BY (IF OTHER THAN BLOCK 7) DCASMA SAN ANTONIO 615 EAST HOUSTON ST. P. O. BOX 1040 SAN ANTONIO, TX 78294-1040		CODE S4404A
8. CODE 29913 NAME & ADDRESS RADIAN CORPORATION 8501 MO-PAC BOULEVARD P. O. BOX 9948 AUSTIN, TX COUNTY: TRAVIS PHONE: (512) 454-4797		9. FACILITY CODE (IF "9" FOR MULTIPLE FACILITIES SEE SECT "K")		10. SECURITY CLAS U
				11. DISCOUNT FOR PROMPT PAYMENT 1ST % DAYS NET D 2ND % DAYS IF V S 3RD % DAYS COTHER SEE '9' SECT "E"
				12. PURCHASE OFFICE POINT OF CONTACT TRX/L72/LRX

13. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

The above mailing date/time is extended as set forth in Block 17.

ADVANCE COPY

14. THIS SICK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS

THIS CHANGE IS ISSUED PURSUANT TO _____
THE CHANGES SET FORTH HEREIN ARE MADE TO THE ABOVE NUMBERED CONTRACT/ORDER.

THE ABOVE NUMBERED CONTRACT IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (SUCH AS CHANGES IN PAYING OFFICE, APPROPRIATION
DATA, ETC.) SET FORTH HEREIN.

THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF "CHANGES" CLAUSE OF THE GENERAL
IT MODIFIES THE ABOVE NUMBERED CONTRACT AS SET FORTH HEREIN.

THIS MODIFICATION IS ISSUED PURSUANT TO _____

15. CONTRACT ADMINISTRATION DATA

A. KING B. MOG ABST C. DATE OF SIGNATURE D. CHANGE IN CONTRACT AMOUNT
OF MOG RECIPIENT ADP PT MODIFICATION INCREASE (+) DECREASE (-) E. LOSING PO/CAO F. GAINING PO/CAO G. SVC/CLNCY
ON TRANSFER ON TRANSFER USE

ENTER ANY APPLICABLE CHANGES

A. PAY B. EFFECTIVE DATE C. CONTRACT D. TYPE E. SURV F. SPL CONTR G. PAYING OFFC H. DATE SIGNED I. SECURITY
CODE OF AWARD CONTR CRIT PROVISIONS CODE
111TYPE 121END 111CLAS 121DATE OF DD-34

SUBJECT: ADJUSTMENT OF EFFORT AND FINANCIAL MONITORING
MONITORING LAB: USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY
PROJECT ENGINEER: EMILE BALADI, USAFOEHL/TSA, BROOKS AFB, TX 78235-5000
FINANCE OFFICE: (S4403A) DCASR DALLAS, 500 S. ERVAY STREET
DALLAS, TX 75201-6377

CONTRACTOR/OFFEROR IS NOT REQUIRED

CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN

TO SIGN THIS DOCUMENT

COPIES TO ISSUING OFFICE

1

10

Fig. 1 A photograph of the ventral view of the head of a female *Leucophaea maderae* showing the mouth parts.

10.000-15.000 m²

21. DATE STAMPED
7/2/86

SCHEDULE OF CHANGES

FIRST: Block 20, Page 1 (55X) of the Basic Order is increased by \$92,235.54 from a not-to-exceed total of \$493,299.64 to a new not-to-exceed total of \$585,535.18.

SECOND: Section C, Description/Specifications, is replaced and superseded by pages 3 through 28 hereof.

THIRD: Section F, Supplies Schedule Data, is amended as shown on page 27 hereof.

FOURTH: Section G, Accounting Classification Data, is amended by adding the information shown on page 28 hereof.

FIFTH: This Supplemental Agreement constitutes full settlement of any claims of the contractor under the clause of the contract, entitled "Changes," arising out of or by reason of the changes effected herein.

36 APR 11

INSTALLATION RESTORATION PROGRAM
PHASE II (STAGE1) - CONFIRMATION/QUANTIFICATION
AIR FORCE PLANT 4 FT WORTH TEXAS *

I. ✓ DESCRIPTION OF WORK

The overall objective of the Phase II investigation is to define the magnitude, extent, direction and rate of movement of identified contaminants. A series of staged field investigations may be required to meet this objective. The contractor shall determine any additional investigations required beyond this stage, including an estimate of costs, for possible performance under a separate contractual action.

The purpose of this task is to conduct a contaminant source investigation at Air Force Plant 4 to determine: (1) the presence or absence of contamination within the specified areas of the field survey; (2) if contamination exists, the potential for migration in the various environmental media; (3) the extent/magnitude of contamination on the Air Force Plant 4 property; and (4) potential environmental consequences and health risks of migrating contaminants based on state or federal standards for these contaminants. ←

Ambient air monitoring of hazardous and/or toxic material for the protection of contractor and Air Force personnel shall be accomplished when necessary, especially during drilling operations.

The Phase I IRP Report and the Hargis & Associates "Interim Progress Report Investigations of Subsurface Conditions US Air Force Plant No. 4 Fort Worth, Texas" (both mailed under separate cover) provide background and description of the sites and investigation area for this task. To accomplish this investigation the contractor shall take the following actions:

A. General

1. Well Installation:

a. Each borehole shall be drilled in accordance with ASTM procedures. Well construction shall be in accordance with appropriate state regulations. State concurrence with method of well construction shall be documented in the draft and final reports. All well installations shall be under the approval and supervised by a geologist or hydrogeologist certified by the American Institute of Professional Geologists (AIPG) or equivalent organization. Final site selection shall be coordinated with General Dynamics facility personnel to avoid interferences with existing utilities and traffic patterns.

b. Install a maximum of twenty-three (23) boreholes for a total of 1220 linear feet. A maximum of fourteen (14) boreholes shall be completed as ground water monitor wells for a total of 930 linear feet. The exact location, depth of boreholes and number of boreholes for each site shall be determined in the field by the contractor in consultation with the Air Force project manager. The approximate locations and number of borings and wells for sites under investigation are given in the site specific section of this task.

c. Each well shall be developed as soon as practical after

INSTALLATION RESTORATION PROGRAM
PHASE II (STAGE1) - CONFIRMATION/QUANTIFICATION
AIR FORCE PLANT 4 FORT WORTH TEXAS *

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c. Each well shall be developed as soon as practical after

completion by blowing with air and pumping or by using a hauler. Well development shall proceed until the discharge water is clear and free of sediment to the fullest extent practical.

d: Field permeability tests shall be performed in accordance with ASTM procedures.

e. Hollow stem auger techniques shall be used to install boreholes and monitoring wells in the upper zone (alluvium) to allow the collection of split-spoon samples. Split-spoon samples shall be collected, containerized, described and logged at 5 ft intervals or at stratum changes. Samples to be analyzed chemically (per para B.) shall be capped, frozen and package for over-night shipment to the appropriate laboratory. Two split-spoon samples from each well/borehole shall be selected based on color, odor, and organic vapor analysis (OVA) and analyzed per Table 2, Atch 2. At a minimum a soil sample from the water table interface and one additional core from each boring shall be submitted for laboratory analysis. The additional core should be from the zone judged to be the most contaminated, based on sample gas analysis, color, odor, etc.

f. Wells shall be constructed and located in a manner which will allow their use in aquifer pumping tests, ground water recovery operations or other future uses.

g. Air rotary methods shall be used for drilling monitor wells into the Paluxy. Special precautions shall be taken to ensure that contaminants are not introduced into the Paluxy during drilling or as a result of migration around the borehole after well installation.

h. PVC flush joint casing and PVC commercially manufactured screen shall be used for all monitor wells. Use only screw type joints. Schedule 40 PVC shall be used for upper zone wells and schedule 30 PVC for Paluxy wells and any well over 100 feet deep. The screen length shall be sufficient to penetrate the aquifer of interest.

i. All wells shall be fitted with a 3 foot, protective steel casing and locking cap with lock. Three iron protective pipes shall be installed around the well for further protection in areas accessible by vehicles. Avoid wells in traffic areas when possible; when necessary install with flush mounted covers painted for corrosion control and visibility.

j. Each well shall receive a filter pack, bentonite seal and have the annular space grouted to the surface. The gravel pack shall be placed at a controlled rate to prevent bridging. A bentonite seal shall be placed above the gravel pack and the rest of the annular space filled with bentonite/cement grout to the land surface.

k. Grouting shall be done using a tremie pipe to assure the entire filling of the annular space in one operation. No pumping or other development operation shall be permitted until the grout has cured.

l. Contaminated water from boreholes and monitoring wells shall be containerized for proper disposal or treated on-site per General Dynamics agreements. These conditions may occur during well development, purging and

during pumping tests.

m. Survey elevations of all newly installed monitoring wells with respect to a U.S.G.S. Bench Mark (if available) near the Plant to an accuracy of 0.05 feet. Horizontally locate the new wells to an accuracy of 1 foot and record on site maps.

n. Well placement shall be coordinated with the proposed Remedial Action Plan as it develops.

o. Obtain any necessary State or local drilling permits.

2. The contractor shall monitor all exploratory well drilling and borehole operations with an OVA instrument to identify potential generation of hazardous and/or toxic materials. In addition, the contractor shall monitor drill cuttings for discoloration and odor. During drilling operations, if soil cuttings are suspected to be hazardous (based on OVA measurement, odors, or discoloration), the contractor shall place them in proper containers and test them for EP Toxicity, Ignitability or organics (EPA Method 624) as appropriate. Containerized hazardous wastes shall be turned over to General Dynamics for disposal. Drums shall be labeled in accordance with the General Dynamics plant hazardous waste identification system. Results of this monitoring shall be included in boring logs.

3. Sampling and Analysis

a. All water samples collected shall be analyzed on site for pH, temperature, and the specific conductance. Sampling, maximum holding time, and preservation of samples shall strictly comply with the following references: Standard Methods for the Examination of Water and Wastewater, current edition; ASTM, Section 11, Water and Environmental Technology; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020. All chemical analyses (water, sediment and soil) shall meet the required limits of detection for the applicable EPA method identified in Table 1, Attachment 1.

b. Locations where water, soil, or sediment samples are taken shall be surveyed and marked where possible with a permanent marker, and the location documented on a project site map.

c. Split all water, sediment and soil samples as part of the contractor's specific Quality Assurance/Quality Control (QA/QC) protocols and procedures. One set of samples shall be analyzed by the contractor. The other set of samples shall be forwarded for analysis through overnight delivery to:

USAFOERL/SA
Bldg 140
Brooks AFB TX 78235

The samples sent to the USAFOERL/SA shall be accompanied by the following information:

- (1) Purpose of sample (analyte)
- (2) Installation name (base)

- (3) Sample number (on containers)
- (4) Source/location of sample
- (5) Contract Task Numbers and Title of Project
- (6) Method of collection (bailer, suction pump, air-lift pump etc.)
- (7) Volumes removed before sample taken
- (8) Special Conditions (use of surrogates, filtering, etc.)
- (9) Preservatives used, especially any nonstandard types.

This information shall be forwarded with each sample by properly completing an AF Form 2752 (copy of form and instructions on proper completion mailed under separate cover). In addition, copies of field logs documenting sample collection parameters should accompany the samples.

Chain-of-custody records for all samples, field blanks, and quality control duplicates shall be maintained. The records shall be appended to the final report.

d. Water levels shall be measured at all monitoring wells to the nearest 0.01 feet as feet below the top of the casing elevation. Record elevations as mean sea level (MSL).

e. All wells shall be purged prior to sampling to ensure that fresh formation water is collected. Purging shall proceed until at least three well volumes of water have been displaced or until pH, temperature, and specific conductance stabilize. If water flow to the well is too low or recharge too slow to meet the above conditions, the contractor shall document the number of volumes purged and sample in the most practical manner to get a representative sample. All sampling in the upper zone shall be conducted using 2-inch stainless steel Kemmerer sampler, teflon bailer, or PVC bailed. Sampling in the Paluxy shall be done with a dedicated pump installed in each well.

f. Second-column confirmation shall be required when volatile organics (VOC) as determined by EPA Methods 601, 602, 8010, and 8020 exceed detection limits in Table 1, Atch 1. Second column confirmation shall be conducted on a maximum of 25% of the samples collected for these analyses. Total number of samples for these VOCs in Table 1, Atch 1 include these confirmation analyses. Report all procedures and conditions used. Do not report numbers unless confirmed by both columns; then only report the first column results.

g. Analyze an additional 10% of all samples, for each parameter, for quality control purposes. These shall include the columns used, conditions, and the two different retention times for major components, (replicate, intralaboratory, and/or interlaboratory analysis and blanks), as indicated in Table 1, Atch 1. Include all quality control data in draft and final report. An example summary table will be forwarded under separate cover.

h. Ground-water elevations shall be measured at three points in time on all wells. One measurement shall be taken when the well is developed, a second when the sample is obtained and the third approximately one month after sampling. Measurements shall be referenced to an established, surveyed mark-point on the top of the well casing.

i. Flow conditions shall be documented for all surface-water sampling.

j. Wells shall be sampled all at once rather than sampling individual wells as they become available.

4. All sampling equipment shall be decontaminated prior to use between samples, and between sampling locations, to avoid cross contamination. Equipment shall be thoroughly washed with a laboratory-grade detergent followed by clean water, solvent (methanol) and distilled water rinses. Sufficient time shall be allowed for the solvent to evaporate and for the equipment to dry completely. The monofilament line or steel wire used to lower bailers into the well shall be dedicated to each well or discarded after each use. The calibrated water level indicator for measuring well volume and fluid elevation must be decontaminated before use in each well.

5. The drilling rig and tools shall receive thorough initial cleaning and be decontaminated after each borehole. As a minimum, drill bits shall be steam cleaned after each borehole is installed. Drilling shall progress from the least to the most contaminated areas, if possible.

6. Field data collected for each site shall be plotted and mapped. The nature, magnitude, and potential for contaminant flow within each zone to receiving streams and groundwaters shall be estimated. Upon completion of each sampling and analysis effort, the data shall be tabulated in the next R&D Status report as specified in item VI, sequence 1 below.

7. Determine the areal extent of the sites by reviewing available aerial photos of the base, both historical and the most recent panchromatic infrared.

B. In addition to items delineated in "A." above, conduct the following specific actions at the indicated sites on AF Plant 4 :

1. General

a. Numerous sites are under active study by Hargis & Associates for General Dynamics and are summarized in "Interim Progress Report Investigation of Subsurface Conditions US Air Force Plant No. 4 Fort Worth Texas, Vol. I - VI".

b. Obtain, review and analyze the reports of ongoing studies currently being conducted by Hargis & Associates for General Dynamics. Geologic and groundwater elevation data shall be analyzed to define the hydrogeologic conditions at the site. Ground-water quality data shall be analyzed to determine any statistical relationships within and among the various wells and their relationship to regulatory standards as well as public health and welfare.

c. Integrate, to the maximum extent possible, any previous results from the General Dynamics study performed by Hargis & Associates.

d. The feasibility of utilizing hydrogeologic models to predict water levels and solute transport shall be evaluated for each site.

e. Analytical data developed previously by Hargis & Associates as well as the above results shall be used to develop remedial action alternatives where possible. At least two options shall be identified for each site. A conceptual description for each option shall include:

- a. Engineering considerations
- b. Environmental impacts and means of mitigation.
- c. Reliability and implementability
- d. Operation and maintenance requirements
- e. Off-site disposal needs
- f. Safety considerations

2. Site 1, Landfill 1

a. Ground-water samples shall be collected at the following existing wells shown in Figure 1, Atch 3:

HM-7,10,18, 20,62,63 and P-4,7 as well as one new well being installed by General Dynamics. These samples shall be analyzed for Volatile Organic Compounds (VOC), Base Neutral & Acid Extractable Compounds (B/N), and heavy metals per Table 2, Atch 2.

b. French drains number 1 and 2 and the drain pipe shall be sampled and analyzed for VOC, B/N, and heavy metals per Table 2, Atch 2.

c. Surface water samples shall be collected at the creek seep as well as creek locations C-1,2,3,4,5 and St-5 outfall. All samples shall be analyzed for VOC,B/N, and heavy metals per Table 2, Atch 2.

d. Determine the effectiveness of the recently installed lines in the storm drain at ST-S outfall in preventing release of contaminants to the creek.

3. Site 3, Landfill 3

a. Conduct geophysical profiles (electromagnetic) to determine the horizontal extent of subsurface contamination, if present. Evaluate the data to determine if soil borings are needed to place the site onto category 1, 2, for 3.

b. Drill one (1) borehole downgradient (Figure 1) into the upper Paluxy to a depth of 150 feet. Complete the borehole as a ground-water monitor well screened in the upper sand unit.

c. Collect one ground-water sample and analyze for VOC, B/N, and heavy metals per Table 2, Atch 2.

d. Ground-water samples shall be collected at the following existing wells shown in Figure 1, Atch 3:

HM-39,38,21,37,27,26,36,35,34

Each sample shall be analyzed for VOC, B/N and heavy metals per Table 2, Atch 2.

4. Site 12, Chrome Waste Pit 3

a. Conduct post closure monitoring at previously installed wells to include:

HM-30, 16, 15, 45, 17, 32, 13, 41 and P-2

Each sample for the above wells shall be analyzed for VOC, B/N and heavy metals per Table 2, Atch 2.

5. Site 17, Former Fuel Storage Site

a. Sample the two existing wells (HM-8, 14) and analyze for HC Fuels (Figure 2, Atch 4) per Table 2, Atch 2.

b. Observe well HM-8 for existence of a fuel lens and determine the thickness if such a lens exists on the water table.

c. Drill one additional borehole and complete as a ground-water monitoring well (maximum of 40 feet deep). Screen at the water table. Analyze one water sample and three (3) soil samples, for HC-fuels per Table 2, Atch 2.

d. If fuel is detected in the upper zone ground water, prepare a Remedial Action Plan addressing alternatives (Item VI, Seq 4).

6. Site 2, Landfill 2

a. Conduct geophysical profiles (electromagnetic) to determine the horizontal extent of subsurface contamination, if present. Evaluate data to determine if soil borings are needed to place the site into category 1, 2, or 3.

b. Install one downgradient paluxy borehole to a depth of 150 feet and complete as a ground-water monitor well screened in the upper sand unit.

c. Obtain ground-water samples and analyze for VOC, B/N, and heavy metals per Table 2, Atch 2.

d. Ground-water samples shall be collected at the following existing wells shown in Figure 2, Atch 4:

HM-2, 22, 40, 42, 43, 44, 46

and analyzed for VOC, B/N, and heavy metals per Table 2, Atch 2.

7. Site 4, Landfill 4

a. Install one upper zone borehole to a depth of 40 feet and complete as a ground-water monitoring well. Collect and analyze one water sample and two (2) soil samples for VOC, B/N, and heavy metals per Table 2, Atch 2.

b. Install one downgradient paluxy borehole to a depth of 150 feet and complete as a ground-water-monitor well screened in the upper sand unit. Obtain ground-water samples and analyze for VOC, B/N, and heavy metals per Table 2, Atch 2.

c. Ground-water samples shall be collected at the following existing wells shown in Figure 2, Atch 4:

HM-5,9

and analyze for VOC, B/N, and heavy metals per Table 2, Atch 2.

8. Zone 1, Including: Site 13, Die Pits; Site 11, Chrome Pit 2; Site 8, Fire Department Training Area 5 (PDTA 5).

a. Ground-water samples shall be collected at the following existing wells adjacent to the excavated die pits as shown in Figure 3, Atch 5:

HM-11,12,24,25,28,60,77
P-1

b. Analyze each of the above samples for VOC, B/N, and heavy metals per Table 2, Atch 2. In addition, analyze samples for PDTA 5 (Pm-77) for HC fuels and oil & grease.

c. Drill an upper zone borehole to a depth of 40 feet. Collect and analyze t-o soil samples for VOC, B/N, and heavy metals per Table 2, Atch 2.

9. Site 15, Fuel Saturation Area 2 (FSA 2)

a. Collect one water sample from the existing monitoring well (HM 80) and analyze for HC Fuels and VOC per Table 2, Atch 2.

b. Observe the well for existence of a fuel lens and determine the thickness if such a lens exists on the water table.

c. Drill three (3) boreholes to an average depth of 30 feet (total of 90 linear feet) along the length of the buried fuel line. Analyze three (3) soil samples from each borehole (based on color, odor, or OVA analysis for HC fuel & VOC per Table 2, Atch 2).

d. If fuel saturation occurs at this site, prepare a Remedial Action Plan (item VI., Seq. 4) addressing alternatives for mitigating the problem.

10. Site 20, Wastewater Collection Basins

a. Drill one upper-zone borehole directly north and downgradient of the basins near the process building to a depth of 40 feet and complete as a ground-water-monitor well.

b. Collect one water sample and two soil samples and analyze for VOC, Oil & Grease, HC Fuels, and heavy metals per Table 2, Atch 2.

c. Collect ground water samples at the following existing wells shown in Figure 3, Atch 5:

HM-31, 47, 69, 70

Each sample shall be analyzed for VOC, Oil & Grease, HC Fuels, and heavy metals per Table 2, Atch 2.

d. Determine the location and depth of the buried sanitary and industrial waste lines. Determine the need for sampling soil along their length based on findings in items 10.a. through 10.c.

11. Site 16, Fuel Saturation Area 3 (rSA 3)

a. Collect one water sample from the existing monitoring well (HM-78) and analyze for HC Fuels and VOC per Table 2, Atch 2.

b. Observe the well for existence of a fuel lens and determine the thickness if such a lens exists on the water table.

c. Review results of on-going studies to determine the areal extent of saturation. Coordinate with the on-going interim Remedial Action Program.

12. Site 9, FDTA 6

a. Collect six (6) soil samples by hand augering. Select one (1) soil sample from each auger core based on color, odor, or organic vapor readings. Collect one ground-water sample from P-3 (Figure 4, Atch 6). Analyze samples for VOC, B/N, oil & grease, and HC Fuels per Table 2, Atch 2.

b. The auger coreholes shall be grouted to the land surface upon completion of sampling.

13. Site 6, FDTA 3

a. Check existing well (HM-33, Figure 2, Atch 4) for a fuel lenses on the water table in the borehole.

b. Convert the existing soil boring (max of 40 linear ft) to a ground-water monitor well screened in the upper zone. Collect one ground-water sample and analyze for VOC, HC Fuels, and Oil & Grease per Table 2, Atch 2.

c. Collect one ground-water sample from existing well HM-33 and analyze for Oil & Grease, VOC, and HC Fuels per Table 2, Atch 2.

14. Site 7, FDTA 4

a. Determine the location of the old fire training area by conducting a soil-gas survey with a maximum of 60 probes traversing the area.

b. Collect one ground water sample and analyze for VOC, Oil & Grease, and HC Fuels per Table 2, Atch 2.

15. Site 18, Solvent Lines

a. Drill one downgradient upper zone borehole (Figure 5, Atch 7) to a depth of 40 feet at a location determined from existing data collected on the wells installed by General Dynamics. Collect two soil samples and analyze for Xylene, Oil & Grease, and methyl ethyl ketone (MEK) per Table 2, Atch 2.

b. Complete the borehole as a ground-water-monitoring well. Collect and analyze samples for oil & grease, xylene, and MEK per Table 2, Atch 2.

c. Collect ground-water samples from HM-72,73,74, and 75. Analyze each sample for xylene, oil & grease, and MEK per Table 2, Atch 2.

16. Site 10, Chrome Pit 1

a. Locate the disposal pit (Figure 3, Atch 5) and drill one upper zone borehole to a depth of 40 ft. Collect two soil samples and analyze for VOC and chromium per Table 2, Atch 2. Coordinate closely with General Dynamics personnel to minimize production/work delays and cost of relocating process equipment.

b. The borehole shall be completed as a ground-water monitoring well. Collect one water sample and analyze for VOC and chromium per Table 2, Atch 2.

c. Collect one sample from existing well HM-48 as well as two new wells to be installed by General Dynamics and analyze for VOC and Chromium per Table 2, Atch 2.

17. Site 5, FDTA 2

a. Collect ground-water samples at existing monitoring wells HM-19, 49, 50, 51, 65, 66, and 76 (Figure 1, Atch 3).

b. Analyze samples for VOC, oil & grease, and HC Fuels per Table 2, Atch 2.

c. Conduct a geophysical profile (electromagnetic) of the area to determine extent of any hydrocarbon plume.

18. Site 14, Fuel Saturation Area 1 (FSA 1)

a. Install one borehole in the upper zone to a depth of 2 feet below the water table (maximum depth of 40 feet) per Figure 1, Atch 3.

b. Collect two soil samples and one water sample and analyze for HC

Fuels per Table 2, Atch 2.

c. Collect groundwater samples from the existing wells HM-53, 55, P 6m, 6u and analyze for HC Fuels per Table 2, Atch 2.

d. Observe the monitor wells for a fuel lense and measure the thickness.

e. Coordinate with on-going interim Remedial Action Project.

19. Ambient Monitoring

Collect ground-water samples from the following existing wells:

HM-29, 52, 54, 56, 57, 58, 59, 61, 64, 79, 81
P- 5u, 5m, 10u, 10m, 9u, 9m, 11u, 11m

and analyze for VOC, B/N, Oil & Grease, HC Fuels, heavy metals, and chromium per Table 2, Atch 2.

20. East Parking Lot

Collect ground-water samples from HM-68, 71, 82 and P 8u, 8m and analyze for VOC, B/N, Oil & Grease, HC Fuels, chromium, and heavy metals per Table 2, Atch 2.

21. Fuel Storage Tank

Collect one ground-water sample from HM-23 (Figure 2, Atch 4) and analyze for oil & grease and HC Fuels per Table 2, Atch 2.

22. Lake Worth Monitor Wells

a. Install one (1) borehole along the northern area of the Plant that borders Lake Worth (Fig 4, Atch 6 and Fig 5, Atch 7.) The borehole shall be drilled into the Paluxy Formation to a maximum depth of 100 feet.

b. The borehole shall be completed as a ground-water-monitoring well. Collect two water samples (one month apart). Each sample shall be analyzed for VOC, B/N, and heavy metals per Table 2, Atch 2.

23. White Settlement Ground-Water-Pumping Effects

a. Review data on pumping records and projected water demands for the city of White Settlement.

b. Review historical records on Paluxy wells at Plant 4, hydrogeologic and water quality data developed during ground-water investigations conducted by General Dynamics, as well as geologic data on the thickness, character, and extent of the Goodland Limestone and Walnut Formations.

c. Evaluate the impact of the above parameters on ground water flow in the Paluxy near AF Plant 4.

d. Determine the direction of ground water flow in the Paluxy and the zone of influence of the White Settlement wells.

24. Nuclear Aerospace Research Facility (NARF)

a. Samples of soil and water shall be collected and analyzed to confirm the presence or absence of radioactive material (RAM) on the surface and subsurface of the former reactor locations as well as the old aircraft decontamination area.

b. Drill three (3) boreholes in the area of the original reactor pits (Figure 4, Atch 6) to a depth of 20 feet (total of 60 linear feet) and complete one as a ground water monitor well. Split spoon samples shall be taken at two (2) foot intervals (total of 30 samples) and analyzed for alpha, beta, and gamma radionuclides per Table 2, Atch 2. Each core section shall be blended prior to analysis to insure characterization of the complete core section.

c. Collect ground-water samples from HM-83, 84, 85 and this new well (total of 4 samples) and analyze for VOC, B/N, heavy metals, oil & grease, RAM and HC Fuels per Table 2, Atch 2.

d. Research past analytical data from wells at Plant 4 and White Settlement for radioruclide results during the NARF operations period. Include any findings in the final report.

e. Coordinate all studies at this site with the Health Physics staff at General Dynamics and the OEHL POC to ascertain exact locations of past operations.

25. Fuel Test Area, Bldg 21:

a. Install a maximum of five (5) soil borings at an average depth of 40 feet (200 ft) per Figure 4, Atch 6. Select two (2) soil samples from each borehole (10 samples) based on appearance and odor and analyze for oil & grease and HC Fuels per Table 2, Atch 2.

b. Complete three (3) borings as ground water monitoring wells (total of 120 linear feet) and collect one water sample from each well (total of 3 samples). Each sample shall be analyzed for oil & grease and HC Fuels per Table 2, Atch 2.

c. Collect eight grab samples and one 8-hour hand composited surface water sample from Outfall 5 (Figure 5, Atch 7) and analyze for oil & grease and HC Fuels per Table 2, Atch 2. Document any observed visible sheen on the water surface of Outfall 5.

d. Collect eight grab samples and one 8-hour hand-composited, surface-water sample from outfall 001 and analyze for oil & grease, HC Fuels, and VOC per Table 2, Atch 2.

26. Field Technical Operations Plan (TOP)

The contractor shall develop a detailed technical field operations plan (specified in sequence 7, item VI below) based on the technical requirements specified in this task description. This plan shall be explicit with regards to field procedures. It shall include but is not limited to field decontamination operations, health and safety procedures, sampling protocol, well purging requirements, disposal procedures for pumped or bailed water, closure procedures for abandoned wells, QA/QC field procedures, updated field schedule, specific field permeability tests to be performed, and etc. The format is forwarded under separated cover. Applicable data listed in sequence 19, item VI below, shall be used in plan preparation.

27. Well Abandonment

a. The contractor shall abandon the boreholes not finished as ground water-monitor wells as if contamination is present (pressure grout from bottom to top with cement grout).

b. The contractor shall evaluate available well abandonment techniques for ground water monitor wells installed at Air Force Plant 4 for this task. This evaluation shall consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for monitor wells. The contractor shall recommend a candidate method(s) or technique to apply. The actual process of ground water monitor well abandonment is not a part of this study.

28. Conduct a literature search for local hydrogeologic conditions and document in the report. Much of this has been done by Bergis & Associates in General Dynamics study (sent under separate cover); Include their results.

29. Inventory all wells on Air Force Plant 4 (active and abandoned) and include in the report. The wells shall be grouped into subsets associated with a particular site, zone, or ambient area (initial grouping by OEHL will be provided under separate cover).

30. The contractor shall evaluate the total system of wells, using Kriging or other scientifically dependable approaches, and recommend an optimal well network redesign for future monitoring efforts at AF Plant 4. Wells which are not necessary for the integrity of the chemical and hydrogeological data base should be identified as candidates for abandonment.

C. Well and Borehole Cleanup

a. All well and boring area drill cuttings shall be removed and the general area cleaned following the completion of each well and boring. Although the suspected hazardous waste shall be tested by the contractor for EP toxicity

and Ignitability, the contractor is not responsible for ultimate disposal of the drill cuttings. Only those drill cuttings suspected as being a hazardous waste (based on discoloration, odor, or organic vapor analysis) shall be properly containerized by the contractor for eventual disposal by General Dynamics.

b. Insure the construction area, including storage areas utilized, are kept clean at all times. Accumulated waste and debris shall be removed on a daily basis or more frequently as directed by General Dynamics. Comply with General Dynamics Plant Services policies with respect to clean-up of the sites after drilling and sampling.

c. Assume responsibility for containment and transportation of waste materials from drilling procedures to the waste storage site designated by General Dynamics.

D. Field Coordination

The contractor shall notify the Air Force Project Officer five (5) days in advance of field activities and sample collection dates.

E. Asphalt Repair

The contractor shall repair asphalt surfaces that are damaged due to various field activities using a quick fix concrete or cold asphalt patch to repair surfaces.

F. Data Review

1. Results of sampling and analysis shall be tabulated and incorporated in the Informal Technical Information Report (as specified in sequence 3, item VI below) and forwarded to the USAFOEHL for review.

2. Field work accomplishments, planned work and results shall be tabulated and forwarded, as available, in the next R&D Status Report.

G. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAFCEBL (as specified in item VI, sequence 4 below) for Air Force review and comment. This report shall include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available geohydrologic cross sections, and laboratory quality assurance information. The report shall follow the USAFOEHL supplied format (mailed under separate cover).

2. The recommendation section shall address each site and list them by categories. Category I shall include sites where no further action (including remedial action) is required. Data for these sites is considered sufficient to rule out unacceptable health or environmental risks. Category II sites are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. Category III sites are sites that will require remedial actions (ready for IRP Phase IV actions). In each case,

the contractor will summarize or present the results of field data, environmental or regulatory criteria, or other pertinent information supporting these conclusions.

3. Prepare briefing materials (no more than 30 Vu-graphs) describing investigation procedures and results, as specified in item VI, sequence 9 below.

B. Meetings

The contractor's project leader shall attend five (5) meetings with Air Force and regulatory agency personnel to take place at a time to be specified by the USAFCEHL. The meeting shall take place at AF Plant 4 for a duration of one day (eight hours).

II. SITE LOCATION AND DATES:

Air Force Plant 4
Date to be established

III. BASE SUPPORT:

General Dynamics will be responsible for activities listed below :

1. Take custody of hazardous drill cuttings and contaminated well water and make proper disposal of the material.
2. Restage drums in Hazardous waste areas to provide working space for sampling and drilling activities when necessary.
3. Set up barricades to isolate drilling area from parking areas and readings.
4. Provide secure staging area for equipment.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. Maj George R. New USAFCEHL/TSS Brooks AFB TX 78235 (512) 536-2158 AV 240-2158	2. Col Marlan J. Sauerickhouse HQ AFSC/SGPB Andrews AFB, DC 20334 (301) 981-5235 AV 858-5235
2. Maj Al Lussier AFFPRO/PD Ft Worth, Texas (817)763-4473 AV 838-5473	

VI. In addition to sequence numbers 1, 5, and 10 in Attachment 1 to the contract, which are applicable to all orders, the sequence numbers listed below are applicable to this order. Also shown are data applicable to this order.

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
19 (Atch 1) Para I.B.26	ONE/R	<u>85Nov15</u>	<u>86Jan31</u>		10
3 (Atch 1) Para I.P.1.	0/Time	*	**		3
4 (Atch 1) Para I.B.5	ONE/R	*	***		8
4 (Atch 1) Para I.G.1.	One/R	<u>86Jun23</u>	<u>86Aug25</u>	<u>87May15</u>	*****
4 (Atch 1) Para I.B.9.d.	ONE/R	*	***	****	8
9 (Atch 1) Para I.G.3.	One/R	86Apr04	86Jun06	86Jul01	3

* As required by the requested analytical method.

** Upon completion of analytical effort before submission of 1st draft report.

*** Three weeks after completion of the analytical effort.

**** Two weeks after acceptance of the draft RAP.

***** Two draft reports will be required. Ten (10) copies of the first draft shall be forwarded to USAFOEHL/TS. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAFOEHL with one (1) copy of the second draft report. Upon acceptance of the second draft, the USAFOEHL will furnish a distribution list for the remaining 24 copies of the second draft. When the second draft is approved the contractor shall supply 50 copies plus the original camera ready copy of the final report.

TABLE 1. AP PLANT4 IRP PHASE II ANALYTICAL PARAMETERS, METHODS, AND DETECTION LIMITS

Parameter	Method	WATER		SOIL	
		Det Limit ^a (ug/L)		Method	Det Limit ^a (ug/g)
VOC	601	b		8010	0.050
VOA	602	b		8020	0.500
B/N	625	h		625	h
2,4-D	8150	1.0		8150	0.1
2,4,5-T	8150	0.1		8150	0.01
TCDD	613	2.0 (ng/mL)		WA84-A0021	1.0
TOC ^c	415.1	1000		na	na
TOX	9020	50		-	-
Phenols	420.2	5		420.2	0.1
O&G	413.2	1000		d	10
HC Fuel	418.1			d	10
MEK	8015	h		8015	h
Xylene (AVO)	8020	h		8020	h
NO ₃	300.0	1000		-	-
C1	300.0	1000		300.0 ^e	10
Color	110.2	1.0 color unit		-	-
MBAS	425.1	25		-	-
TDS	160.1	1000		-	-
SO ₄	300.0	1000		300.0 ^e	-
P	300.0	100		300.0	10
ECO ₃	310.1	1000 as CaCO ₃		-	-
CN	335.3	10		335.5	0.1
pH	150.1	.01 pH unit		9040	0.01
Conductivity	120.1	1 umho		9050	1.0 umho
As	206.2	2		7060	0.2
Ba	200.7	1		6010	0.1
Cd	200.7	2		6010	0.2
Cr	200.7	5		6010	0.5
Pb	239.2	2		7421	0.2
Hg	245.1	0.2		7471	0.005
Se	270.2	2		7740 ^f	0.2
Ag	200.7	2		6010 ^f	0.2
Cu	200.7	1		6010 ^f	0.1
Pe	200.7	8		6010 ^f	0.8
Mn	200.7	1		6010 ^f	0.1
Zn	200.7	3		6010 ^f	0.3
Na	200.7	30		6010 ^f	3.0
Ca	200.7	50		6010 ^g	5.0
Mg	200.7	30		6010 ^g	3.0
Be	200.7	1		6010 ^f	0.1

Hazardous Wastes

1

Annex 1

NOTES (TABLE 1):

- a. Detection limits listed are method detection limits (i.e. analysis of interference free samples). Practical Quantitation Level (PQL), defined as the lowest achievable level of analytical quantitation during routine laboratory operating conditions within specified limits of precision and accuracy (EPA, 50FR219, page 46904), may differ.
- b. Detection limits for Purgeables (Volatile Organic Compounds, VOC) shall be as specified for the compounds by EPA Methods 601 & 602 (water) or EPA Methods 8010 & 8020 (solid matrix). These methods require positive confirmation by a second gas chromatographic column. This must be done before reporting positive values. The methods specify the two columns to use. Second column confirmation is required when values exceed:

Benzene	0.7 ug/L
Carbon Tetrachloride	4.0 ug/L
1,2 Dichloroethane	0.1 ug/L
Methylene Chloride	4.0 ug/L
Tetrachloroethylene	4.0 ug/L
Trichloroethylene	1.0 ug/L
Vinyl Chloride	1.0 ug/L
Dichlorobenzene isomers	Sum greater than 10 ug/L
Any other organic	Greater than 10 ug/L

Retention time on both columns must match before reporting positive values. If no match occurs, it will be considered an interference.

If questions are encountered about certain contaminants, you may be asked to show both chromatograms to rule out the possibility of interferences.

VOC = Purgeables = Volatile Halocarbons(VOX) + Volatile Aromatics(VOA)

c. Detection limit for TOC must be 3 times the noise level of the instrument. Laboratory distilled water must show no response; if it shows a response, corrections of positive results must be made.

d. Analysis of Oil and Grease (O&G) by 413.2 (IR) after Extraction with Method 3550.

e. Deionized Water Extraction.

f. Digestion with Method 3050.

g. Digestion with lithium metaborate (LiBO_2) for Ca and Mg.

h. Detection limits specified by the EPA method.

i. SUSPECTED HAZARDOUS WASTES :

i. SUSPECTED HAZARDOUS WASTES:	EP Toxicity	EPA 1310	c
	Ignitability	PCPA	*
	Purgeables	EPA 624	c

* Hazardous waste if ignitable at 140 degrees Fahrenheit or below.

TABLE 2 SUMMARY DRILLING AND SAMPLING DATA FOR AP PLANT 4, FT WORTH TX: PHASE II, STAGE 1

SITE	LOCATION	TYPE SAMPLE	BH BH(FT)		BH BW(FT)		VOC	B/N	OLG	Heavy Metals	Fuel	XYLENE	Cr	MEK	BAM
			#	W	#	W									
1	Landfill 1	G						9	9						
3	Landfill 3	G	1	150	1	150		10	10						
12	Chrome Waste Pit 3	G	2	190	2	190		10	10						
17	Former Fuel Storage Site	G	1	40	1	40		9	9						
2	Landfill 2	G	1	150	1	150		8	8						
4	Landfill 4	G	2	190	2	190		4	4						
Zone 1		G	1	40				2	2						
15	Fuel Saturation Area 2	S	3	90				8	8	1					
20	Wastewater Collection Basins	G	1	40	1	40		9	9						
16	Fuel Saturation Area 3	G						2	2						
9	FDTA 6	G						1	1						
6	FDTA 3	G	1	40	1	40		6	6						
18	Solvent Lines	G	1	40	1	40		5	5						
10	Chrome Pit 1	G	1	40	1	40		2	2						
5	FDTA 2	G	1	40	1	40		2	2						
14	Fuel Saturation Area 1	G	1	40				7	7						
Ambient Monitoring		G						25	25						
Last Parking Lot		G						5	5						
Fuel Storage Tank		G						5	5						
Lake Worth Monitor Wells		G	1	100		100		2	2						
NAPF Area		G	3	60	1	20		4	4						
Fuel Test Area, Bldg 21		G	5	200	3	120		3	3						
		W						10	10						
		W						18	18						
Sub Totals			23	1220	14	930		145	105	97	105	114	7	34	7
QA/QC Samples								51	11	10	11	12	1	4	4
Total Samples with QA/QC								196	116	107	116	126	6	36	8

KEY (TABLE 2): VOC = Volatile Organic Compounds

U/N = Base Neutral and Acid Extractable Compounds

O/G = Oil and Grease

RAM = Alpha, Beta, and Gamma radionuclides.

Samples: G = Ground Water W = Surface Water S = Soil

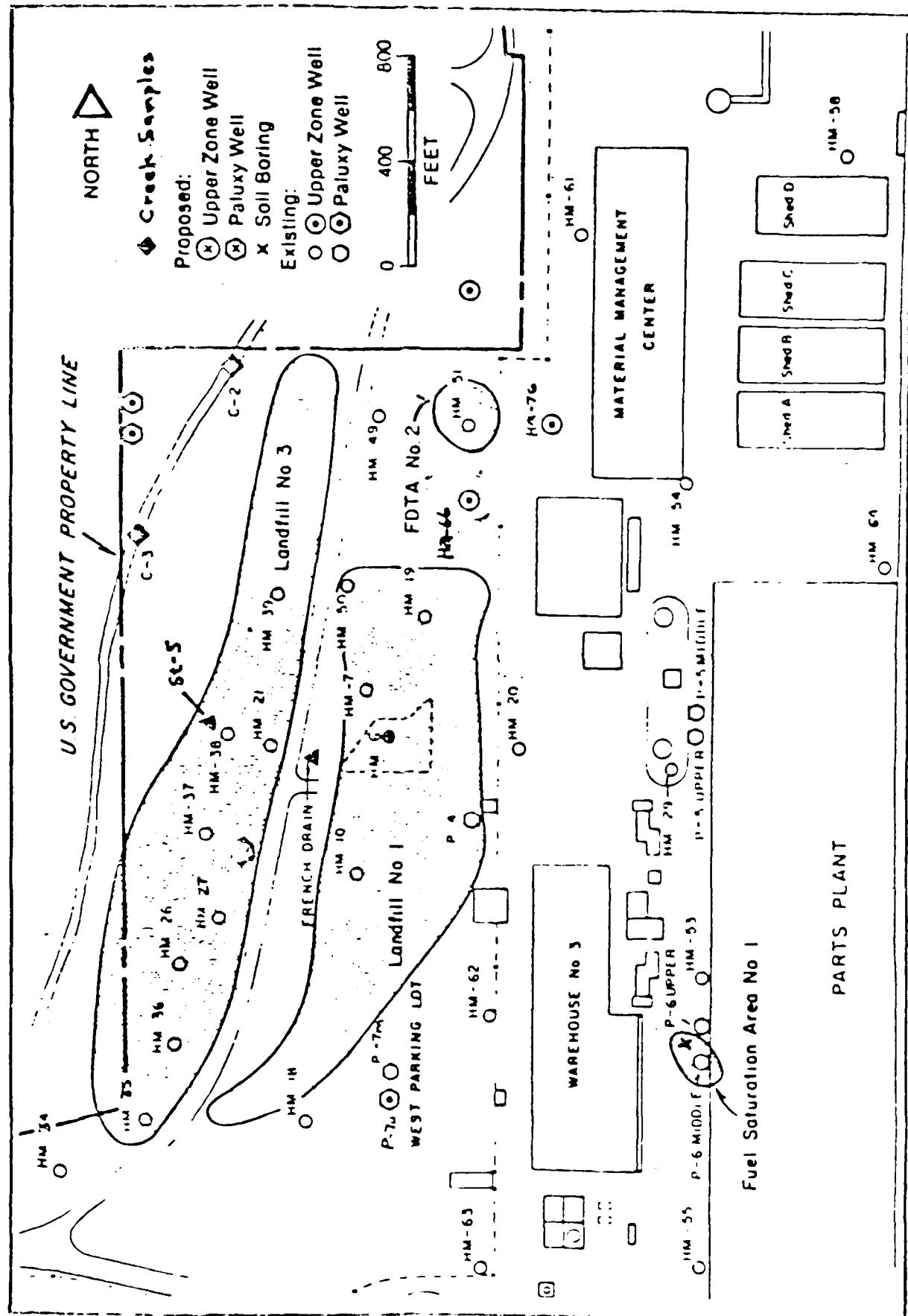


Figure 1. Landfills 1, 3; Fuel Saturation Area 1; and FDIA 2.

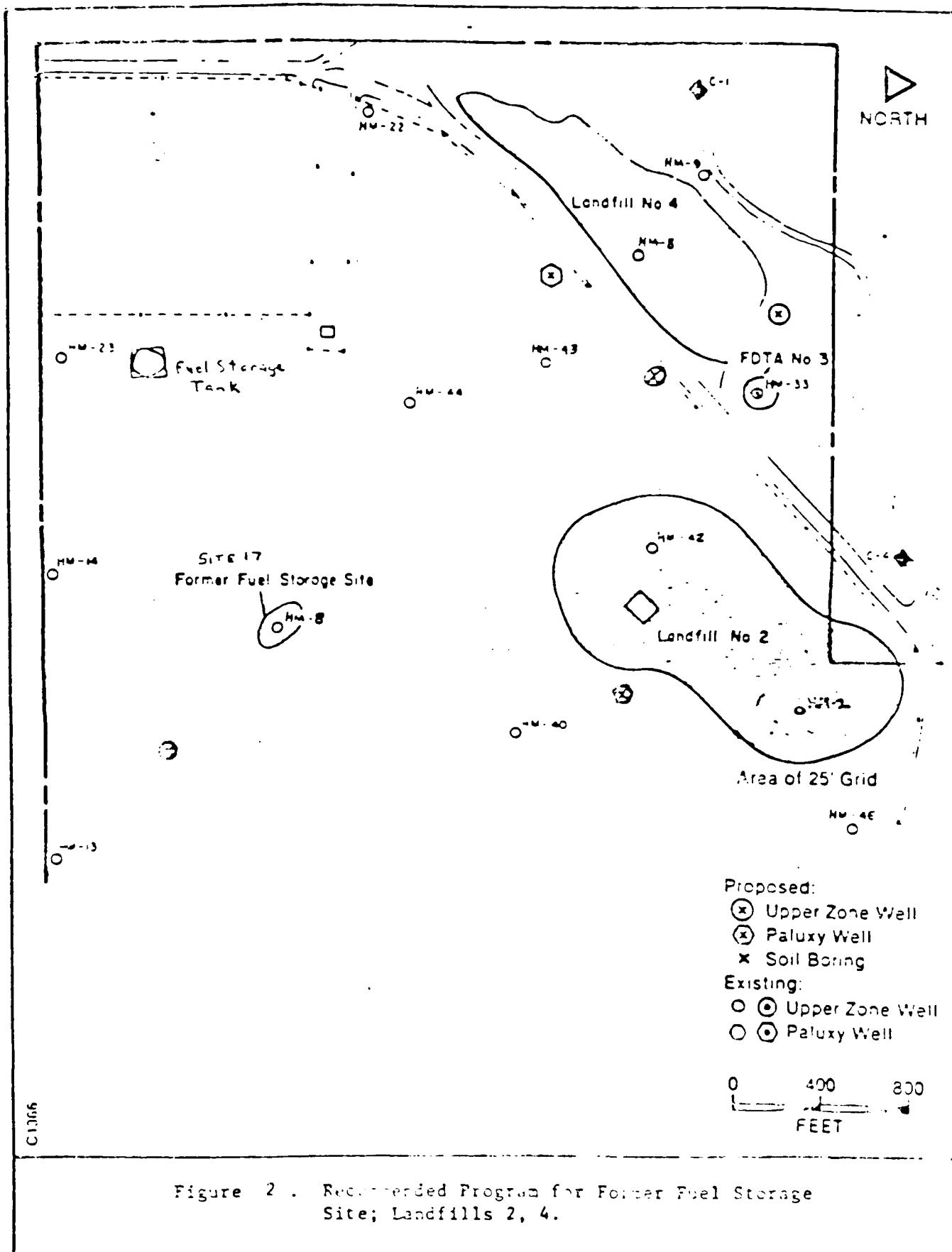


Figure 2 . Recommended Program for Former Fuel Storage Site; Landfills 2, 4.

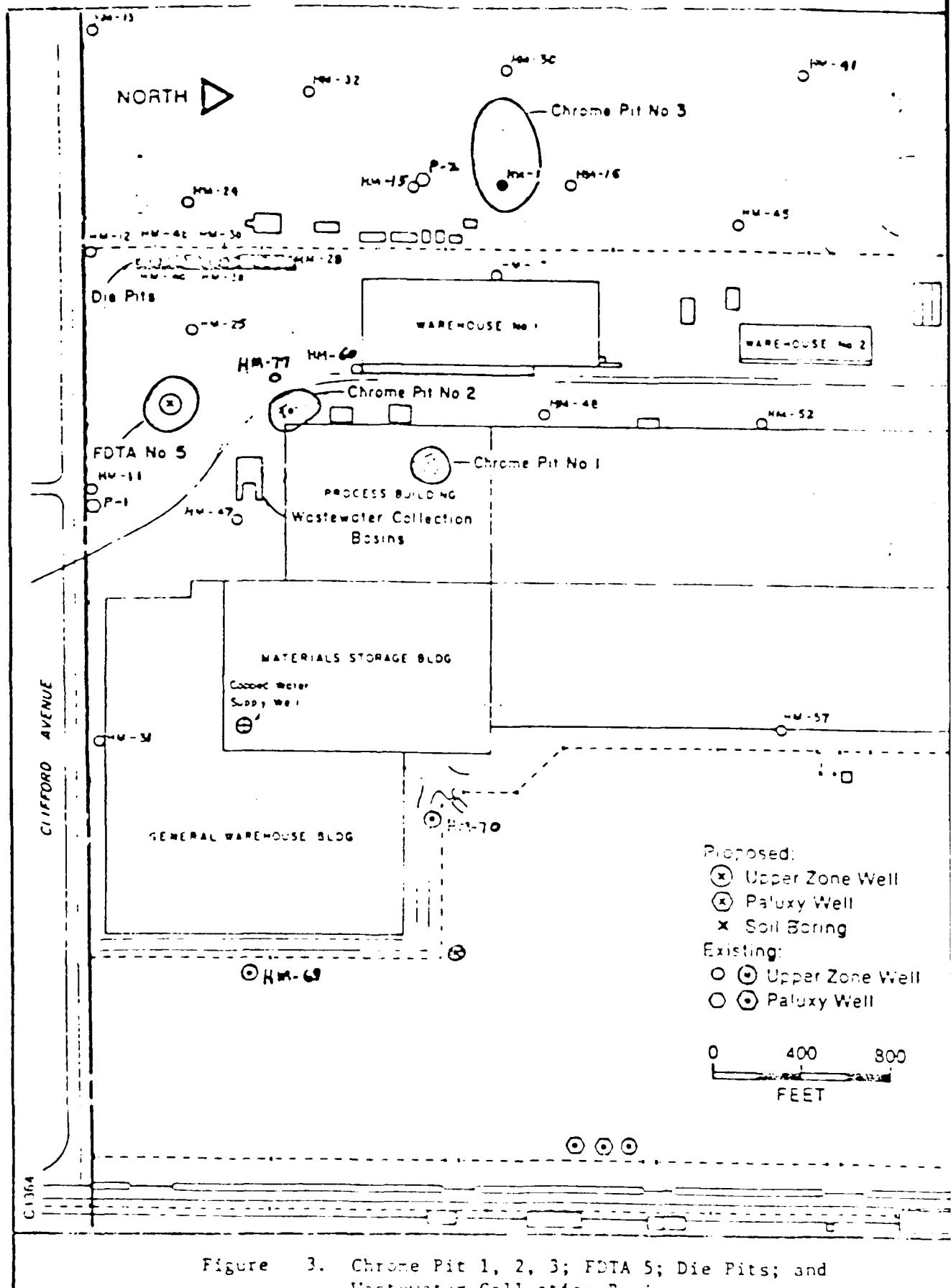


Figure 3. Chrome Pit 1, 2, 3; FDTA 5; Die Pits; and Wastewater Collection Basins.

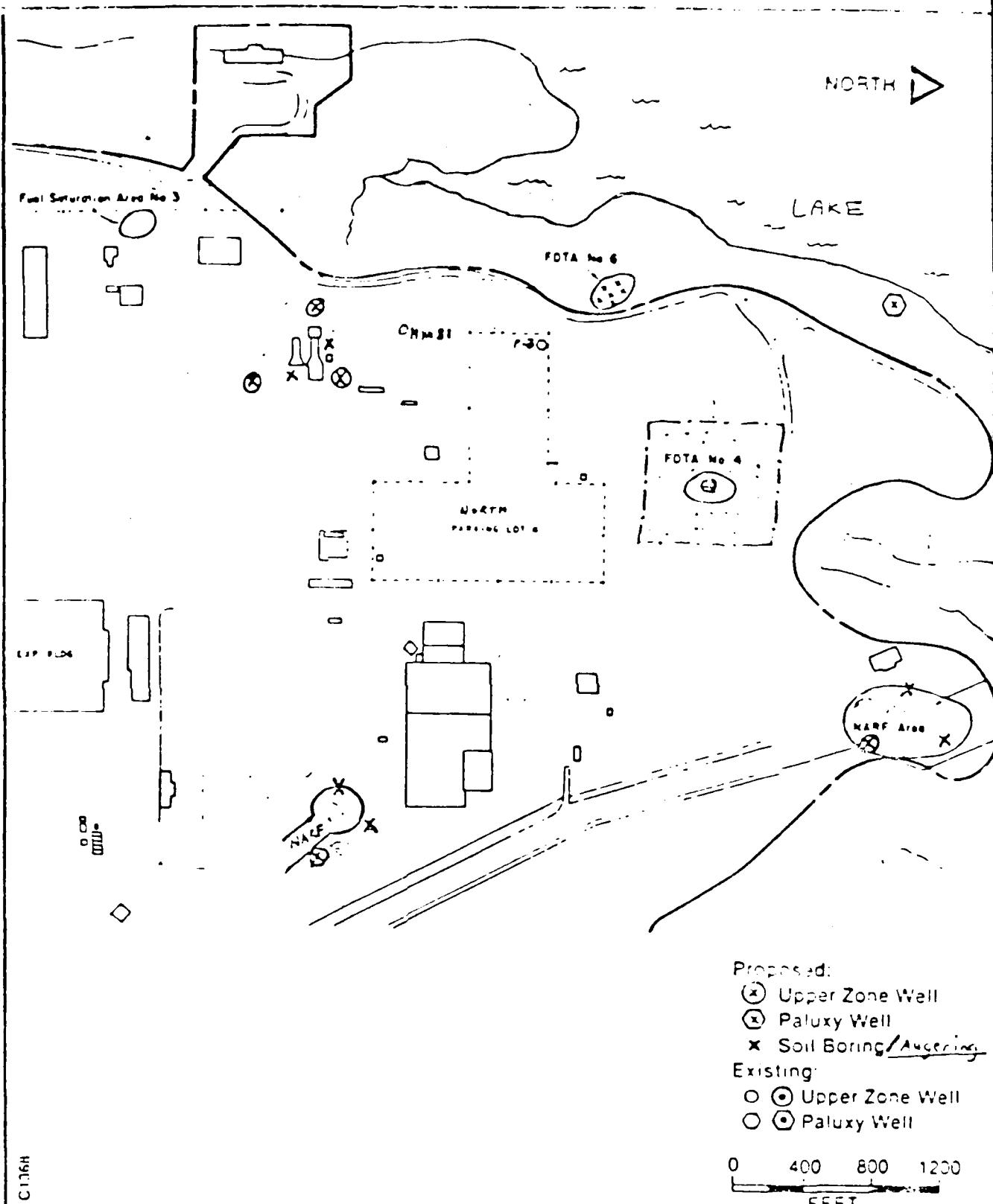


Figure 4. Fuel Saturation Area 3; FDA 6, 4; NARF Area; Lake Worth Wells; and Fuel Test Area.

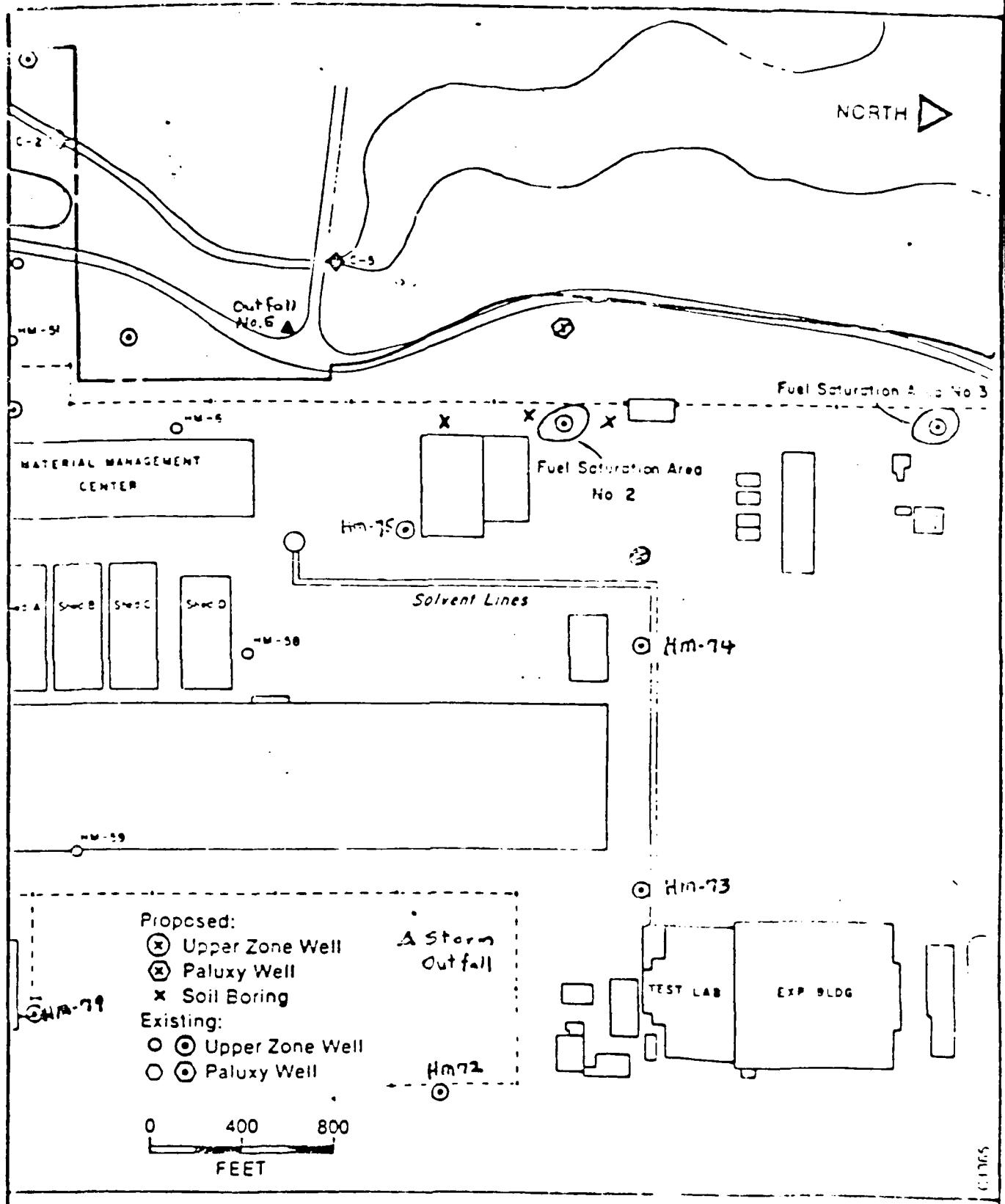


Figure 5. Recommended Program for Solvent Lines and Fuel Saturation Area 2.

SECTION F OF THE SCHEDULE
SUPPLIES SCHEDULE DATA

4. ITEM NO.	5. ACRN	6. TSP	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO.	10. CLN/IDENT EXHIBIT
	PRI				(WHEN APPL)	

0001 AA

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY	15. SHIP TO	16. MARK FOR
A. 87JUL15	A.	A. 1	CLAS	U FY7624	
B.	B.	B.	D.	D.	D.
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H OF BASIC CONTRACT FOR FY7624 ADDRESS.

TECHNICAL EFFORT COMPLETED 86 APR 04. THE DATE SHOWN IN BLOCK 11A IS THE GOVERNMENT ACCEPTANCE OF DATA DATE.

DATA TO BE DELIVERED IN ACCORDANCE WITH ATTACHMENT #1, AS IMPLEMENTED BY PARAGRAPH VI OF THE AMENDED TASK DESCRIPTION NO LATER THAN 87 MAY 15.

4. ITEM NO. 5. ACRN 6. TSP 7. MILSTRIP DOC NO. AND SUFFIX 8. CON ITEM SERIAL NO. 9. ENDING SERIAL NO. 10. CLN/IDENT EXHIBIT

0004 AA

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY	15. SHIP TO	16. MARK FOR
A. 87JUL15	A.	A. 1	CLAS	U FY7624	
B.	B.	B.	D.	D.	D.
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H OF BASIC CONTRACT FOR FY7624 ADDRESS.

TECHNICAL EFFORT COMPLETED 86 APR 04. THE DATE SHOWN IN BLOCK 11A IS THE GOVERNMENT ACCEPTANCE OF DATA DATE.

DATA TO BE DELIVERED IN ACCORDANCE WITH ATTACHMENT #1, AS IMPLEMENTED BY PARAGRAPH VII OF THE AMENDED TASK DESCRIPTION.

4. ITEM NO. 5. ACRN 6. TSP 7. MILSTRIP DOC NO. AND SUFFIX 8. CON ITEM SERIAL NO. 9. ENDING SERIAL NO. 10. CLN/IDENT EXHIBIT

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY	15. SHIP TO	16. MARK FOR
A.	A.	A.	CLAS		
B.	B.	B.	D.	D.	C
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

*REPRESNTS A NET INCREASE OR DECREASE WHEN NO + OR - APPEARS AFTER THE ITEM NO

E = ESTIMATED

+ (IN QTY) = INCREASE

- (IN QTY) = DECREASE

C = R = (IN ITEM NO.) = CANCEL OR CREDIT

K
 PART I SECTION G OF THE SCHEDULE
 CCC CUTOFF CLASSIFICATION DATA

A. APPROPRIATION AND ACCOUNTING DATA A/C/CY CLAS B/ACRN	B. LIMIT C. APPROPRIATION	C. APPROPRIATION NO. (P/N)	D. PAYING DFC CODE
U AA 5763400		F33615-83 D-1001	002702 PAGE 28 OF 28
E. CPN RECIPIENT G/LOAD	G. OBLIGATION AMOUNT*	H. NON-CLIN/ELIN	I. PR/MIPR DATA
E28500	S 92,235.54+		J. PAYING DFC CODE
K. DESCRIPTIVE DATA		FY7624-86-01004 (PR COMPLETE)	
CCC: 10G002			

A. APPROPRIATION AND ACCOUNTING DATA A/C/CY CLAS B/ACRN	B. LIMIT C. APPROPRIATION	C. APPROPRIATION NO. (P/N)	D. PAYING DFC CODE
			SUPPLEMENTAL ACCTG CLASSIFICATION

E. CPN RECIPIENT G/LOAD	G. OBLIGATION AMOUNT*	H. NON-CLIN/ELIN	I. PR/MIPR DATA	J. PAYING DFC CODE
	S			
K. DESCRIPTIVE DATA				

A. APPROPRIATION AND ACCOUNTING DATA A/C/CY CLAS B/ACRN	B. LIMIT C. APPROPRIATION	C. APPROPRIATION NO. (P/N)	D. PAYING DFC CODE
			SUPPLEMENTAL ACCTG CLASSIFICATION

E. CPN RECIPIENT G/LOAD	G. OBLIGATION AMOUNT*	H. NON-CLIN/ELIN	I. PR/MIPR DATA	J. PAYING DFC CODE
	S			
K. DESCRIPTIVE DATA				

A. APPROPRIATION AND ACCOUNTING DATA A/C/CY CLAS B/ACRN	B. LIMIT C. APPROPRIATION	C. APPROPRIATION NO. (P/N)	D. PAYING DFC CODE
			SUPPLEMENTAL ACCTG CLASSIFICATION

E. CPN RECIPIENT G/LOAD	G. OBLIGATION AMOUNT*	H. NON-CLIN/ELIN	I. PR/MIPR DATA	J. PAYING DFC CODE
	S			
K. DESCRIPTIVE DATA				

A. APPROPRIATION AND ACCOUNTING DATA A/C/CY CLAS B/ACRN	B. LIMIT C. APPROPRIATION	C. APPROPRIATION NO. (P/N)	D. PAYING DFC CODE
			SUPPLEMENTAL ACCTG CLASSIFICATION

E. CPN RECIPIENT G/LOAD	G. OBLIGATION AMOUNT*	H. NON-CLIN/ELIN	I. PR/MIPR DATA	J. PAYING DFC CODE
	S			
K. DESCRIPTIVE DATA				

*REFRESENTS NET AMOUNT OF INCREASE OR DECREASE WHEN MODIFYING AN EXISTING ACRN
 - OR - IN ACRN ADDITION OR DELETION IN S DECREASE NOTE TO CONTRACTOR: If the above office
 address information provided in the above form is incorrect, contact AFSC.



APPENDIX D

Well Numbering System



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APPENDIX D

Well Numbering System

The wells and borings drilled at Air Force Plant 4 during the Phase II investigation are identified by an alpha-numeric label. Upper Zone aquifer monitor wells are labeled with the letters HM or F followed by a dash and a number. The HM stands for Hargis-Montgomery (Hargis and Associates) whereas the F represents those monitor wells installed by Intellus Corporation. Hargis-Montgomery installed HM wells 1 through 85 and Radian installed HM wells 100 through 108. Monitor wells drilled into the Paluxy Formation are denoted by the prefix P followed by a number and in most cases the number is followed by a U or an M representing completion in the Upper Paluxy and Middle Paluxy, respectively. Where the P is followed by a number only, the well was completed throughout a larger interval of the Paluxy Formation aquifer. Soil borings are labeled with the letters SB followed by a number.



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TABLE D-1. WELL INVENTORY

P-1	HM-1	HM-47	F-200
P-2	HM-2	HM-48	F-201
P-3	HM-3A	HM-49	F-202
P-4	HM-3B	HM-50	F-203
P-5U	HM-4A	HM-51	F-204
P-5M	HM-4B	HM-52	F-205
P-6U	HM-5	HM-53	F-206
P-6M	HM-6	HM-54	F-207
P-7U	HM-7	HM-55	F-208
P-7M	HM-8	HM-56	F-209
P-8U	HM-9	HM-57	F-210
P-8M	HM-10	HM-58	F-211
P-9U	HM-11	HM-59	
P-9M	HM-12	HM-60	
P-10U	HM-13	HM-61	
P-10M	HM-14	HM-62	
P-11U	HM-15	HM-63	
P-11M	HM-16	HM-64	
P-12U	HM-17	HM-65	
P-12M	HM-18	HM-66	
P-13U	HM-19	HM-67	
P-13M	HM-20	HM-68	
P-20M	HM-21	HM-69	
P-21U	HM-22	HM-70	
P-22U	HM-23	HM-71	
P-23U	HM-24	HM-72	
	HM-25	HM-73	
	HM-26	HM-74	
	HM-27	HM-75	
	HM-28	HM-76	
	HM-29	HM-77	
	HM-30	HM-78	
	HM-31	HM-79	
	HM-32	HM-80	
	HM-33	HM-81	
	HM-34	HM-82	
	HM-35	HM-83	
	HM-36	HM-84	
	HM-37	HM-85	
	HM-38	HM-100	
	HM-39	HM-101	
	HM-40	HM 102	
	HM-41	HM-103	
	HM-42	HM-104	
	HM-43	HM-105	
	HM-44	HM-106	
	HM-45	HM-107	
	HM-46	HM-108	



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APPENDIX E

Lithologic Logs



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not included in page count]



Soil Boring Logs

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-1
Location Fuel Saturation Area No.2
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/24/86 and end
1/24/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
-		G		ASPHALT: 0-0.25'.	
-		G		FILL: 0.25-1.0'.	
-		G		CLAY: minor silt and sand, orange and tan, plastic, moist to dry, moisture decreases with depth (1-4').	
--					
-					
-					
-	4-5	ST		CLAY: mottled orange and tan, tan especially noted along bedding planes. Dry (GOODLAND FORMATION.)	HNU 0.3 w/ 0.1 BG Polytest- (slight yellow ring)
5-					
-					
-					
-					
-	9-9.3	ST		CLAYEY SHALE: minor coarse sand and gravel, calcareous, mottled tan, orange and gray, dry.	
10-					
-					
-					
-					
-	14-	ST		SHALE: calcareous, dark gray, orange red iron stains along fractures, dry.	HNU 0.2 w/ 0.15 BG Polytest-very slight yellow ring) Benzene (neg)
15-	14.5				
-					
-					
-					
-	19-	ST		SHALE: gray, fissile and dry.	HNU 0.2 w/ 0.15 BG
20-	19.2				
-					
-					
-					
-				LIMESTONE: fossiliferous, gray, sandy. (WALNUT FORMATION.) TD = 22'.	
--					
--					
--					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-2
Location Fuel Saturation Area No.2
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube.
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/24/86 and end 1/24/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
-		G		ASPHALT: 0-0.3'. FILL: 0.3-1'.	
-		G		CLAY: minor silt and sand, orange and tan, plastic, moist to damp, moisture decreases with depth.	
-					
-	4-4.3	ST		CLAYEY SHALE: calcareous, mottled orange and tan, dry.	HNU 4.0 w/ 0.4 BG
5-	5-6	ST		CLAYEY SHALE: same as above. (GOODLAND FORMATION.)	Polytest- (green ring, 3mm) TCE (neg)
-					
-					
-	9-9.2	ST		CLAYEY SHALE: calcareous, mottled orange and tan, plastic and slightly damp.	HNU 13.0 w/ 0.4 BG
10-	10-11	ST		CLAYEY SHALE: same as above.	Polytest- (brown ring on a green ring, 4mm) MEC (neg)
-					
-					
-	14-	ST		CLAYEY SHALE: minor gravel, calcareous, mottled orange, tan and gray, slight plastic to friable, dry.	HNU 1.0 w/ 0.6 BG
15-	14.5				
-					
-					
-					
-	19-	ST		CLAYEY SHALE: same as above. (WALNUT FORMATION at 19.2').	HNU 1.0 w/ 0.6 BG
20-	19.2				
-					
-				LIMESTONE: fossiliferous, gray, sandy. TD = 21'. TCE (trichloroethylene) MEC (methylene chloride)	
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-3
Location Fuel Saturation Area No.2
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/26/86 and end 1/26/86 of drilling operation
Type Drill Rig and Operator CME-75,
R. Cheek
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Taken	Type Graphic Log	Stratigraphy	Remarks
-		G		ASPHALT: 0-0.3'.	
-				SILT: clayey with fine sand and minor gravel, yellow brown, plastic, damp.	
--		G		SILT: same as above except yellow.	
-	4-4.3	ST		CLAYEY SHALE: minor gravel, mottled tan and gray, slight fissile and dry. (GOODLAND FORMATION.)	HNU 0.4 w/ 0.1 BG
5-					
-					
-					
-					
-	9-10	ST		CLAYEY SHALE: same as above but damp to dry.	HNU 1.2 w/ 0.0 BG Polytest- (brownish green ring apx. 2 mm)
10-					
-					
-					
-	14-	ST		CLAYEY SHALE: minor sand, calcareous, mottled, tan, orange and gray, damp to dry.	HNU 0.1 w/ 0.0 BG
14.8					
15-					
-					
-					
-	19-	SS		No returns.	HNU 0.2 w/ 0.0 BG
19.1				LIMESTONE: fossiliferous, gray, sandy. (WALNUT FORMATION.)	
20-				TD = 22	
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. SB-4
Location Fuel Saturation Area No.1
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube.
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/26/86 and end
1/26/86 of drilling operation
Type Drill Rig and Operator CME-75,
R. Cheek
Sampling Interval (Estimated) 5 ft

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. SB-4
Location Fuel Saturation Area No.1
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/26/86 and end
1/26/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
20-					
-					
-					
--					
-					
-					
-	24-24.5	ST		SAND AND GRAVEL: calcareous, mottled tan and gray to black, sand is rounded, gravel is angular limestone.	Hydrocarbon odor
-	24.5-25.5	SS			HNU 25.0 w/ 1.0 BG
25-				SAND AND GRAVEL: same as above but wet.	Polytest- (brown ring, 0.5")
-					40 blows-1'
-					Hydrocarbon odor
--					
-	28-28.3	ST		CLAY AND GRAVEL: tan, primarily pea size limestone gravel, subangular to subrounded, moderately sorted, wet. TD = 28'.	
-					
-					
-					
30-					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. SB-5
Location Die Yard
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/23/86 and end
1/23/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Log		
-		G		CEMENT: 0-0.5'.		
-						
-						
-						
-	4-5	ST		SAND: minor silt, calcareous, orange and tan, fine to very fine grained sand, rounded, fairly well sorted and slightly damp. GRAVELY from 6-8'.	HNU 0.0 w/ 0.0 BG	
5						
-						
-						
-						
-	9-10	ST		CLAY: some silt, calcareous, mottled tan and orange, silt tends to be orange, slight damp to damp.	HNU 0.0 w/ 0.0 BG	
10						
-						
-						
-						
-						
-	15.5-	ST		SHALE: calcareous, tan, hard, somewhat fissile and dry. (GOODLAND FORMATION.)	HNU 0.0 w/ 0.0 BG	
-	16				Polytest- (slight green ring)	
-					TCE (neg)	
-						
-						
-	19-	ST		SHALE: same as above.	HNU 0.1 w/ 0.1 BG	
-	19.4				Toluene (neg)	
20						
-						
-						
-						
-						

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. SB-5
Location Die Yard
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/23/86 and end
1/23/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Sample	Stratigraphy	Remarks
			Graphic Log		
20-					
-					
-					
--					
-					
-	24-25	ST		SHALEY CLAY: calcareous, mottled orange, HNU 0.1 w/ tan, and gray, plastic.	0.05 BG
25-					
-					
-					
--					
-					
-	29-	ST		SHALE & CLAYEY SHALE: calcareous, mot- tled, orange, tan and gray, slightly fissile and dry.	HNU 0.1 w/ 0.1 BG
-	29.5			Alternating shale and limestone layers from 29.5-33'.	
30-					
-					
-					
--					
-					
-		G		LIMESTONE: fossiliferous at 33'. (WALNUT FORMATION.)	HNU 0.1 w/ 0.1 BG
35-				TD = 33.5'.	

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-6

Location NARF Area

Log Recorded by Peter A. Waterreus

NOTES: BG=Background, ST=Shelby Tube.

SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP

Beginning 7/21/86 and end

7/21/86 of drilling operation

Type Drill Rig and Operator CME-55,

Ray Henry

Sampling Interval (Estimated) 2 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-					
-					
-					
--	2-3	ST		SANDY CLAY AND GRAVEL: mottled, red, yellow, brown and black, calcareous, dry to damp.	
-					
-					
--	4-5	ST		SANDY CLAY AND GRAVEL: same as above.	AID 1.0/1.0 BG.
-					
5-					
-					
-	6-7	ST		SANDY CLAY AND GRAVEL: tan and yellow, fossiliferous (exogyra), calcareous, damp.	
-					
-					
-					
-	8-8.5	SS		SANDY CLAY: minor gravel, tan and yel- low, some fossils (exogyra), hard, calcareous, damp to moist.	50 blows for 2.5". AID 1.0/1.0 BG.
10-				TD:: 9 ft. Walnut Formation.	

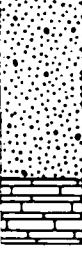
RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-7
Location NARF Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 7/21/86 and end
7/21/86 of drilling operation
Type Drill Rig and Operator CME-55,
Ray Henry
Sampling Interval (Estimated) 2 ft

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Stratigraphy		
-						
-						
-	2-2.5	ST		GRAVEL AND SANDY CLAY: mottled brown, tan and white, fossiliferous (exogyra), hard, dry.		
-						
--						
-						
-						
-						
-						
5-				TD: 4 ft. Walnut Formation.		AID 1.0/1.0 BG. No return.

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-8
Location NARF Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 7/21/86 and end
7/21/86 of drilling operation
Type Drill Rig and Operator CME-55,
Ray Henry
Sampling Interval (Estimated) 2 ft

Depth	Sample			Stratigraphy	Remarks
	Sample	Zone	Type Taken	Graphic Log	
-					
-					
-	2-3	ST			SAND: minor gravel and caliche, sand is red, fine-grained, fairly well sorted, slightly damp.
--					
-					
-					
-					
5-					CONCRETE from 4-5.5'.
-					
-					
TD: 5.75'. Walnut Formation.					
-					No returns.
-					End of rod
-					is wet.
-					AID 1.0/1.0 BG
-					
-					
-					
10-					
-					
-					
-					
-					
15-					
-					
-					
-					
20-					
-					
-					
-					

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-9
 Location Building 21
 Log Recorded by Peter A. Waterreus
 NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
 Beginning 7/22/86 and end 7/22/86 of drilling operation
 Type Drill Rig and Operator CME-55,
Ray Henry
 Sampling Interval (Estimated) 5 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-	0-0.75			CONCRETE.	
-	0.75-2	G		CLAY: dark gray, some sand, damp to moist, plastic, hydrocarbon odor.	
-	2-3	G		CLAY: dark brown, plastic, damp.	
--					
-	3-4	G		CLAY: same as above but damp to moist.	AID 42/1.0 @ 4'.
-	4-5	ST		CLAY: mottled brown and black, some yellow, minor sand, plastic, tough.	Draeger poly-test (green & brown noted after 1 pump, 16 mm)
5-	5-9	G		CLAY: minor limestone sand and gravel, plastic, tough, brownish gray.	
-					
-					
-					
-					
-	9-10	ST		CLAY: minor limestone gravel, fossils, mottled dark red and brownish-black.	AID 185/1.0 hydrocarbon odor strong plus liquid hydrocarbons
10-					
-					
-					
-	12	G		CLAY: with some limestone gravel and sand, exogyra, tan, plastic.	
--					
-					
-	14-15	ST		SAND, GRAVEL, CLAY: mottled tan, white, brown, crumbly, dry, exogyra.	AID 12/1.0 sl. hydrocarbon odor
15-					
-					
-					
-	17	G		CLAY and SAND: tan, plastic, damp water seepage into hole.	Sl. hydrocarbon odor
--					
-					
-	19-20	ST		GRAVEL, SAND, CLAY: tan plus brown, fossils, wet.	AID 120/1.0 Draeger poly-test (brown and green, 35 mm)
20-	20.5			TD: Walnut Formation.	
-					
-					
-					
--					

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-10
 Location Building 21, Fuel Area
 Log Recorded by Peter A. Waterreus
 NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
 Beginning 7/22/86 and end 7/22/86 of drilling operation
 Type Drill Rig and Operator CME-55,
Ray Henry
 Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
-	0-0.5	G		CONCRETE.	
-	0.5-0.67	G		FILL SAND and minor gravel.	
-	0.67-3	G		CONCRETE COBBLE FILL.	
-					
--					
-	3-4	G		SANDY CLAY: minor gravel, sand is medium-grained, tan; clay is brown, plastic, damp.	
-					
-					
-	4-5	ST		SANDY GRAVELLY CLAY: mottled dark brown and tan, gravel and sand is limestone, exogyra; clay is plastic, tough, dry to slightly damp.	AID 1.0/1.0.
5-					
-					
-					
-	6	G		CLAY; brownish gray, plastic, tough.	
-					
--					
-					
-	9-10	ST		CLAY/SHALE/CALICHE: clay is tan-brown, slightly plastic, dry. Shale is bluish gray. Caliche white.	AID 33/1.1.
10-					
-					
-	11	G		SANDY CLAY: tan, slightly plastic, dry to slightly damp.	
-					
--	13.5	G		GRAVELLY CLAY: sandy, gravel is fossiliferous (exogyra) limestone; sandy clay as above. 14-15 same as above but dry to moist 15-15.5 clay, mottled, calcareous (weathered Goodland Formation?).	AID 13/1.2 86 blows.
-	14-15.5	SS			
-					
-					
15-					
-					
-					
-	17	G		CLAY: with some limestone. Clay is tan, dry, calcareous.	
--					
-					
-	19-19.5	SS		SHALE: with minor clay, mottled tan and gray, dry, some fossils. Walnut limestone at bottom.	AID 1.1/1.1 50 blows
20-				TD: 19.5 ft.	

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-11

Location NARF Area

Log Recorded by Peter A. Waterreus

NOTES: BG=Background, ST=Shelby Tube,

SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP

Beginning 7/24/86 and end 7/24/86 of drilling operation

Type Drill Rig and Operator CME-55,

Ray Henry

Sampling Interval (Estimated) 2 ft

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Log		
-						
-						
-	2-3	ST		SANDY, GRAVELLY CLAY: mottled tan, brown, red, slightly plastic, limestone gravel, slightly damp, roots.		
--						
-						
-	4-4.5	SS		LIMESTONE AND CLAY: limestone is weathered and tan. Clay is brown, slightly plastic, dry to slightly damp, some exogyra. TD: 4.75 ft. Walnut Formation.		AID 0.4/0.4 BG
5-						

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. SB-12
Location NARF Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 7/24/86 and end
7/24/86 of drilling operation
Type Drill Rig and Operator CME-55,
Ray Henry
Sampling Interval (Estimated) 2 ft

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Graphic Log		
-	0-0.5	G		SAND FILL.		
-	0.5-1.5	G		WEATHERED LIMESTONE: exogyra, dry, pow- dery, white. TD: 1.5 ft.		
-						
-						
-						
-						
5-						



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Well Logs

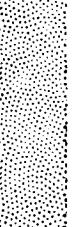
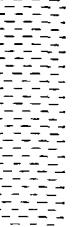
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LOG OF DRILLING OPERATIONS

Sheet 1 of 3

Boring or Well No. HM-100
Location Former Fuel Storage Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel

Project Air Force Plant 4 IRP
Beginning 1/20/86 and end
1/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) Continuous

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Graphic		
-	0-4	CB		CLAY: minor gravel, clay is dark brown, plastic, firm and damp to moist. Gravel is light colored, subrounded and poorly sorted.		HNU 0.2 w/ 0.15 BG
-	4-7.5	CB		CLAY: same as above. CLAY: limestone gravel and minor calcareous sand. Clay is light brown and dry to damp. Gravel is subangular to subrounded and poorly sorted. SAND: limestone gravel and minor clay. Calcareous, light brown, crumbly and dry. Gravel increases with depth.		
5	9-12	CB		SAND: same as above except color is orange brown.		
10				SAND: same as above except clay content increases.		
15	14-18.5	CB		SILT: Sand, calcareous, orange brown, slightly consolidated and slightly damp. Sand is very fine to fine grained and fairly well sorted.		HNU 0.25 w/ 0.2 BG
20	19-23.5	CB		SILT: same as above.		HNU 0.2 w/ 0.2 BG

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LOG OF DRILLING OPERATIONS

Sheet 2 of 3

Boring or Well No. HM-100
Location Former Fuel Storage Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel

Project Air Force Plant 4 IRP
Beginning 1/20/86 and end
1/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) Continuous

Depth	Sample Zone	Sample Taken	Type Graphic Log	Stratigraphy	Remarks
20-					
-					
-					
--					
-					
-					
-					
24-29	CB			SILT: sand and minor gravel, calcareous, orange brown, crumbly to slightly plastic and slightly damp.	
25-					
-					
-					
-					
29-33	CB			SILT: same as above except tan and dry. SILT: same as above.	
30-				SILT: some sand and minor large gravel, calcareous, mottled tan and yellow, slightly consolidated and slightly damp.	
-					
-					
-					
34-36	CB			SAND: gravel, mottled tan and red, calcareous, poorly sorted, surrounded to subangular and moist to wet. Moisture increases with depth.	HNU 0.3 w/ 0.3 BG
35-					
-					
-					
-					
39-42	CB			SAND: calcareous, tan, fine grained to very fine, fairly well sorted, surrounded HNU 0.3 w/ and saturated.	HNU 0.3 w/ 0.3 BG
40-				SAND: gravelly, calcareous, tan. Sand is fine grained to very fine. Gravel increases with depth. Saturated to wet.	
-				Moisture decreases with depth.	
--					

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LOG OF DRILLING OPERATIONS

Sheet 3 of 3

Boring or Well No. HM-100
Location Former Fuel Storage Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel

Project Air Force Plant 4 IRP
Beginning 1/20/86 and end
1/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) Continuous

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy		Remarks
				Sample		
40-						
-						
-						
--						
-						
-						
-						
45-	44-48	CB		SAND: same as above except just wet.		HNU 0.3 w/ 0.3 BG
-				SAND: some limestone gravel. Cal- careous, tan, poorly sorted, moder- ately rounded sand with angular small gravel, saturated.		
-						
--						
-						
-						
-						
TD:	49 ft.					
50-						

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LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. HM-101
Location FDTA No.3 Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/21/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

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LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. HM-101
Location FDTA No. 3 Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube.
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/21/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Sample	Graphic Log	Stratigraphy	Remarks
			Graphic Log			
20-						
-						
-						
-						
-						
-	24-25	ST			SAND AND LIMESTONE GRAVEL: sand is lime- HNU 0.3 w/ stone and quartz grains, tan, poorly 0.3 BG sorted, subrounded, sand, wet.	
25-						
-						
-						
-						
-	29-30	ST			SAND AND LIMESTONE GRAVEL: same as above but mottled tan and orange.	
30-						
-					Walnut Formation at 31'.	
-					LIMESTONE: fossiliferous, medium to dark gray, sandy, dry.	
-						
-		SS			No returns. TD: 34 ft.	HNU 0.45 w/ 0.3 BG 50 blows=0.25"
35-						

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CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. HM-102
Location Landfill No.2 Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background. ST=Shelby Tube.
SS=Split Spoon. G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/23/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Zone	Sample			Stratigraphy	Remarks
		Sample Taken	Type	Graphic Log		
-		G			CLAY: some limestone pea gravel and minor sand. Dark brown, plastic and slightly damp.	
-		G			SAND: orange, very fine to fine grained, well sorted, subround to round, dry. Also contains some dark brown clay streaks.	
5-						HNU 0.1 w/ 0.1 BG
-	5.5-	ST			SAND: also contains silt, clay and limestone gravel. Orange brown, calcareous, poorly sorted, subrounded, dry.	Polytest (neg)
-	6.5					
-	9-9.3	SS			SAND AND LIMESTONE: sand is calcareous, dark orange brown, fine grained, well sorted, subrounded to rounded, dry, limestone is buff, hard, competent with some weathered portions. LIMESTONE: from 9.3 to 12' layers of weathered and unweathered, buff and dry.	Toluene test (neg) 50 blows=3 in.
10-						
-	14-15	ST			(Goodland Formation.) SHALE: mottled orange and tan layer and a dark gray layer, calcareous, fissile, slight plastic to plastic, consolidated, slight damp.	HNU 0.25 w/ 0.25 BG
15-						
-	19-	ST			SHALE: dark bluish gray, calcareous, plastic, consolidated, slightly fissile, slight damp.	HNU 0.25 w/ 0.25 BG
-	19.5					
20-						

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CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. HM-102
Location Landfill No.2 Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/23/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
20-					
-					
-					
-					
-					
-					
-					
25-		G		SHALE: same as above; however, lime-stone lenses up to 0.5' alternate with the shale from 20-41'. Noted by the driller.	HNU 0.0 w/ 0.0 BG
-					
-					
-					
-					
30-				No returns.	HNU 0.0 w/ 0.0 BG
-					
-					
-					
-					
34-	34.1	SS		SHALE: calcareous, dark gray, plastic, consolidated, slight fissile, slight damp.	HNU 0.0 w/ 0.0 BG 50 blows=1".
35-					
-					
-					
-					
40-		SS		No returns for sample. (Walnut Formation.) LIMESTONE: very fossiliferous, medium to dark gray, somewhat sandy. From 41-44'. TD: 44 ft.	HNU 0.0 w/ 0.0 BG 50 blows=0"
-					
-					
-					
-					

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LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. HM-103
Location NE Corner of Bldg. 188
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/21/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

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CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. HM-103
Location NE Corner of Bldg. 188
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/21/86 and end
1/21/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
20-					
-					
-					
--					
-					
-	24-25	ST		CLAYEY SILT: same as above but with minor subrounded poorly sorted lime-stone gravel.	HNU 0.2 w/ 0.2 BG
25-					
-					
-					
--					
-	29-30	ST		SILT: same as above except the gravel is primarily pea size and mod. sorted. Noted some water on outside of the Shelby tube.	HNU 0.3 w/ 0.2 BG Polytest (neg)
30-					
-					
-					
--					
-	34-35	ST		SILT: same as above except very minor gravel and moist to wet.	HNU 0.4 w/ 0.2 BG
35-					
-					
-		G			
--					
-	38-39	SS		SHALE: bluish gray, calcareous at 36' (GOODLAND FORMATION.) SHALE: calcareous, bluish gray, fissile, hard and wet.	HNU 0.4 w/ 0.2 BG
-					
-					
40-				TD: 39 ft.	

TCE = Trichloroethylene

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LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. HM-104
Location Wastewater Collection Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/22/86 and end
1/23/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

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LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. HM-104
 Location Wastewater Collection Area
 Log Recorded by Peter A. Waterreus
 NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
 Beginning 1/22/86 and end
1/23/86 of drilling operation
 Type Drill Rig and Operator CME-75,
Baggett
 Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
20-					
-					
-					
-					
-					
-	24-	SS		SHALE: calcareous, dark gray, compact and gray.	HNU 0.45 w/ 0.25 BG
-	24.9				Polytest- (slight green ring)
25-					TCE (neg)
-					48 blows=10.5"
-					
-					
-	29-	SS		SHALE: same as above.	HNU 6.3 w/ 0.3 BG
-	29.1				50 blows=1"
30-					
-					
-					
-					
-	34-	SS		SHALE: calcareous, same as above with intermittent limestone layers as noted by cuttings.	50 blows=0.5"
-	34.1				
35-		G		LIMESTONE: fossiliferous, gray, sandy. (WALNUT FORMATION at 36').)	
-					
-					
-					
-		SS		No returns. TD = 39 ft.	50 blows=0.25"
40-					

TCE = trichloroethylene

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LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. HM-105
Location Building 21, Fuel Test Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 8/11/86 and end
8/11/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
-	0-0.75	G		CONCRETE.	
-					
-					
--					
-					
-					
-	4-5	ST		CLAY: minor gravel and sand, brown and gray. Clay is plastic and slightly damp.	
5-					
-					
-					
--					
-					
-	9-10	ST		CLAY: same as above.	Draeger poly-test (neg).
10-					
-					
-					
--					
-					
-	14-15	ST		CLAY: mottled tan and gray, calcareous, dry (weathered Goodland Formation?).	Draeger poly-test (neg).
15-					
-					
-					
--					
-					
-	18.5	G		CLAY: same as above but moist and gravel. Walnut Formation at 19'.	Draeger poly-test (slight purple tint & green tint)
20-					
-					
-					
--					
-					
-				TD: 21 ft.	
-					
-					
--					
-					
-					

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LOG OF DRILLING OPERATIONS

Sheet 1 of 2

Boring or Well No. HM-106
Location NW Corner of Solvent Line
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/26/86 and end
1/26/86 of drilling operation
Type Drill Rig and Operator CME-75,
R. Cheek
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
-				CONCRETE: 0-1'.	
-				FILL: 1-2', sand with silt and minor gravel, tannish brown, slightly damp.	
-					
--					
-				SILT AND SAND: minor gravel, red, plastic.	
-				SAND: some gravel and minor silt, calcareous, brown, sand is fine to medium grained, unconsolidated, dry to slightly damp.	HNU 0.1 w/ 0.1 BG
5-					
-					
-					
-					
-					
-					
9-9.7	ST			SAND: same as above except sand is medium to coarse grained and damp.	HNU 0.15 w/ 0.1 BG
10-					
-					
-		G		CLAY: minor gravel and sand, tan, slight damp to dry.	
-					
-					
14-15	ST			CLAY AND SHALE: calcareous, mottled tan and gray, tough, plastic, red roots present, slight damp. Shale more notable at 14.8'.	HNU 0.1 w/ 0.0 BG
15-				(GOODLAND FORMATION.)	
-					
-				LIMESTONE layer at 18', 0.5' thick.	
-					
19-	ST			SANDY SHALE: calcareous, mottled tan and gray, dry.	HNU 0.1 w/ 0.0 BG
19.5					
20-					
-					
-					
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 2

Boring or Well No. HM-106
Location NW Corner of Solvent Line
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 1/26/86 and end
1/26/86 of drilling operation
Type Drill Rig and Operator CME-75,
R. Cheek
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Taken	Type Graphic Log	Stratigraphy	Remarks
20-	-			Alternating layers of shale and limestone from 23-29'.	
-					
-					
-					
-	24-	ST		SANDY SHALE: same as above.	HNU 0.1 w/ 0.0 BG
-	24.5				
25-	-				
-					
-					
-					
-					
-		SS		No sample recovery.	HNU 0.15 w/ 0.15 BG 50 blows=1"
30-	-			LIMESTONE: sandy, gray, fossiliferous. (WALNUT FORMATION.)	
-					
-					
-					
-					
-					
-					
35-				TD = 34'.	

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. HM-107
Location Building 21, Fuel Test Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube.
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 8/11/86 and end
8/11/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 1

Boring or Well No. HM-108
Location Building 21, Fuel Test Area
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 8/11/86 and end
8/11/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
-		G		FILL: calcareous sand, fine-grained, gravel, dry, orange brown.	
-					
-					
--					
-					
-					
4-5		ST		CLAYEY SAND AND GRAVEL: orange brown, calcareous, dry.	
5-					
-					
-					
--					
-					
-					
9-10		ST		CLAY: sandy, minor calcareous gravel, plastic to stiff, dry to slightly damp, dark brownish gray.	Draeger poly-test (slight brownish tint).
10-					
-					
-					
--					
-					
-					
14		G		SILT AND GRAVEL: lenses of both from 13-14', calcareous, fissiliferous, dry 14-14.2'. Calcareous shale, lenses of weathered and unweathered shale, tan and bluish gray, dry to slightly damp. TD: 15 ft. Walnut Formation.	Draeger poly-test (as above).
15-					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Taken	Type	Graphic Log	Stratigraphy	Remarks
-		G			SOIL: silt and fine sand, dark brown, dry.	
-		G			SHALE: calcareous, some limestone, dry. Goodland Formation.	
-						
-						
5-	5-5.2	ST			SHALE: calcareous, some clay and lime- stone, tan, orange iron stains, laminae, dry to slight damp.	HNU 0.05 w/ 0.05 BG
-						
-						
-						
10-	10-10.3	ST			SHALE: same as above but minor clay.	HNU 0.05 w/ 0.05 BG
-					SHALE: gray to light gray.	
-						
-						
15-	15-15.2	ST			SILTY SHALE: calcareous, some clay, mottled tan and gray, dry.	HNU 0.15 w/ 0.15 BG
-						
-						
20-	20-20.7	ST			CLAYEY SHALE: calcareous, dark gray, semi-hard, laminae, fissile, dry.	HNU 0.25 w/ 0.20 BG
-						
-						
-						
-						

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Type Taken	Sample	Stratigraphy	Remarks
			Graphic Log		
-					
-					
-					
-					
-					
-					
25	25-25.2	ST		SHALE: calcareous, gray to dark gray, hard, laminae, fissile, dry.	HNU 0.25 w/ 0.20 BG
-					
-					
-					
-					
30	30-30.2	ST		SHALE: same as above.	HNU 0.30 w/ 0.25 BG
-					
-					
-		G		CLAYEY SHALE: calcareous, dark gray, semi hard, laminae, fissile, dry.	
-					
-					
35	35-36	ST		SILTY SHALE: calcareous, dark gray, laminae, fissile, dry.	HNU 0.35 w/ 0.30 BG
-					
-					
-					
40		ST		No returns. Walnut Formation. Mud rotary drilling.	HNU 0.30 w/ 0.30 BG
-					
-					
-					
-					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 3 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
-						
-						
-						
-						
-						
-						
45		G		SHALE AND LIMESTONE: shale is cal- careous and gray. Limestone is tan and gray and fossiliferous.		
-						
-						
-						
-						
-						
-						
-						
50		G		SHALE AND LIMESTONE: same as above but more fossiliferous.		
-						
-						
-						
-						
55		G		SHALE: calcareous, dark gray.		
-						
-						
-						
-						
-						
-						
-						
60		G		LIMESTONE AND SHALE: limestone is gray and tan and fossiliferous. Shale is cal- careous and dark gray.		
-						
-						
-						
-						
-						
-						

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 4 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Cebbert
Sampling Interval (Estimated) 5

Depth	Zone	Sample Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Type		
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
65	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
70	-	G	-	CLAYEY SILTY SHALE: minor limestone, shale is calcareous and dark gray.	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	G	-	CLAYEY SHALE: minor limestone, shale is calcareous and dark gray.	-	-
-	-	-	-	-	-	-
75	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	G	-	SANDSTONE AND SHALE: sand is quartz, gray to white consolidated to weak cal- crite cement. Shale is gray.	-	-
-	-	-	-	-	-	-
80	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
--	-	-	-	-	-	-

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 5 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500: Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample			Stratigraphy	Remarks
	Sample	Zone	Type Taken	Graphic Log	
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
85	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
90	-	-	G	SANDSTONE: minor clay, quartz, very fine to fine, well sorted, rounded to sub-rounded, consolidated, dry to slight damp.	
-	-	-	-		
-	-	-	-		
-	-	-	-		
95	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
100	-	-	G	SANDSTONE AND SAND: interbedded. Sandstone is quartz, very fine, pyritized cement, very hard. Sand is very fine to fine, well sorted, rounded to subrounded, dry.	
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 6 of 8

Boring or Well No. P-20m

Location Radar Range, S. of Landfill 4

Log Recorded by Peter A. Waterreus

NOTES: BG=Background, ST=Shelby Tube,

SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP

Beginning 2/24/86 and end 3/04/86 of drilling operation

Type Drill Rig and Operator Gardner

Denver 1500; Lee Gebbert

Sampling Interval (Estimated) 5

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-					
-					
-					
--		G		SANDSTONE: quartz, white, very fine, calcite cement.	
-					
-		G		SAND: quartz, gray, very fine to fine, loose, well sorted, rounded, damp.	
105					
-					
-					
-					
--		G		CLAYEY SAND: quartz, gray, very fine to fine, well sorted, rounded, loose to semi-consolidated, slight damp.	
-					
110		G		CLAYEY SAND: same as above but consolidated due to clay matrix, slight damp to dry.	
-					
-					
-					
115		G		CLAYSTONE: sandy, mottled red and gray, firm, dry.	
-					
-					
-					
120		G		CLAYSTONE: sandy, greenish gray, very fine to fine, firm, dry.	
-					
-					
-		G		Pyrite.	
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 7 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-					
-					
-					
--		G		CLAYSTONE AND SANDSTONE: minor silt-stone, the claystone is as above. Sandstone is quartz, white, fine, well-sorted, rounded, silica cement. Siltstone is dark gray and firm.	
-					
-					
-					
-					
125-		G		SANDSTONE: some claystone and minor pyrite sandstone is white to tannish white, very fine to fine, well sorted, rounded, consolidated with calcareous cement. Claystone is as above.	
-					
-					
-					
-					
130-					
-	131-	SS		SAND: grayish white with slight pink hue, very fine to fine, well sorted, rounded, damp. Some minor greenish clay.	
-	131-2				
-					
--					
-					
-					
135-					
-					
-					
-					
-					
137-	SS			SAND: same as above but noted more greenish clay possibly a small lens.	
137.2					
--					
-					
-					
-					
140-					
-					
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 8 of 8

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end
3/04/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Log		
-						
-						
-						
-						
-						
-						
-						
145-	145-	SS		SAND: same as above but moist.		
-	145.3					
-						
-						
-						
-						
150-	150-	SS		SAND: same as above but wet.		
-	150.5					
-						
-						
-						
155-	155-	SS		SAND: same as above.		
-	155.1			TD = 155 ft.		

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 6

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-				0-5 clayey silt minor SAND & GRAVEL. Dark brown slight damp-dry roots, plastic.	
-					
-					
-					
-					
-					
5-	5-6	ST		SAND/SILT: Very fine to coarse, plastic, slightly damp. Minor is gravel, calcareous, mottled dark brown and orange and white-is poorly sorted angular-subrounded.	
-					
-					
-					
10-	10-	ST		CLAY/SILT: minor graven and sand, reddish brown with white caliche, calcareous, plastic, slight damp-dry.	HNU 0.25 w/ 0.25
-	11.1				Polytest neg.
-					
-					
15-	15-	ST		SAND AND GRAVEL: sand is orange subrounded fine to coarse, slight calcareous due to LS sand with quartz. Gravel is LS white-tan fine grained sand to small cobble.	HNU 0.25/ 0.25
-	15.5				
-					
-					
20-	20-	ST		SAND: minor is gravel-subrounded, orange, medium grain, well sorted quartz (not calcaroues), slightly damp-dry, roudned-subrounded.	HNU 0.35/ 0.30
-	21.1				
-					
-					
-					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 6

Boring or Well No. P-2lu
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Log		
-						
-						
-						
-						
-						
-						
25-	25-26	ST		SAND AS ABOVE 25.5. SILT SAND & GRAVEL worm tubes system mottled orange and tan, damp-moist.		HNU 0.35/ 0.35
-						
-						
-						
-						
30-	30-32	ST		29 hit alot of LS & fossils (oysters) in SAND. Hit water. SAND and some LS gravel. SAND medium grained, sub-angular to round, wet, sand is mainly quartz to aprox. 20% LS and light orange. LS is white-tan.		HNU 0.35/ 0.35
-						
-						
-						
35-	35-	ST		LS gravel & SAND: slight orange, wet saturated, very fine (minor silt, sand is primarily quartz with some CACO ₃ . LS-mottled tan and orange, small-large gravel.		HNU 0.35/ 0.3
-	35.7			At 37' hit walnut.		
-						
-						
40-				40.5 ft. No returns.		
-						
-						
-						
-						
-						

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 3 of 6

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

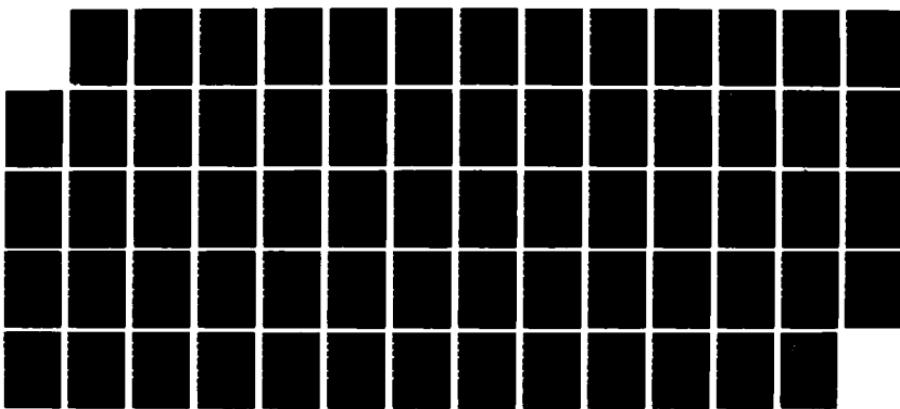
Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

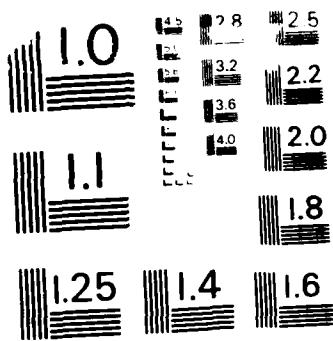
AD-A198 448 INSTALLATION RESTORATION PROGRAM PHASE 2
CONFIRMATION/QUANTIFICATION STAG (U) RADIAN CORP
AUSTIN TX DEC 87 F33615-83-D-4001 2/2

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MICROCOPY RESOLUTION TEST CHART
MAKING A REALITY STANDARDS - 1981

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 4 of 6

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BC=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500: Lee Gebbert
Sampling Interval (Estimated) 5

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 5 of 6

Boring or Well No. P-2lu
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Zone	Sample Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Type		
-						
-						
-						
-						
-						
-						
85-		G		SAND: minor pyrite, grayish white, fine, well sorted, rounded, dry.		
-		G		SAND: same as above but damp.		
-						
-						
90-		G		CLAYEY SAND: sand is fine, well sorted, rounded, mixture is damp to moist.		
-						
-						
-		G		CLAYEY SAND: same as above but damp to dry.		
-						
95-		G		CLAYEY SAND: same as above.		
-						
-						
-						
100-		G		SANDSTONE: loose to consolidated with minor pieces having calcite cement. Grayish white, fine, well sorted, rounded, moist.		
-						
-						
-						
-						
-						

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 6 of 6

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end
3/10/86 of drilling operation
Type Drill Rig and Operator Gardner
Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Type Taken	Graphic Log	Sample	Stratigraphy	Remarks
				Graphic Log		
-						
-						
-						
-						
-						
-						
105		G		CLAYSTONE AND CLAYEY SAND: interbedded, greenish, firm, dry to slight damp, sand is fine grained and rounded.		
-						
-						
-						
-						
-						
110		G		SANDY SHALE: brownish gray, firm, slightly fissile, dry.		
				TD @ 110 ft.		

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 3

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end
3/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Type Taken	Graphic Log	Stratigraphy	Remarks
-				TOPSOIL: with asphalt, moist, yellow-brown with gray silty shale.	Draeger poly-test (pos) 1 stroke HNU 35
-					
-					
-					
-					
-					
5-	5-10			SHALE: silty, gray, with hard limestone fragments. Wet at 9-10', making water.	Contaminated cuttings 5-5.5', strong petroleum odor.
-					
-					
-					
10-		ST		No sample. SHALE: silty, hard, with limestone fragments, turning to well consolidated limestone at 15'.	0.0
-					
-					
-					
15-				FOSSILIFEROUS LIMESTONE: and shale, indurated, shale in calcareous.	0.0
-					
-					
-					
--		ST		At 18' no sample. LIMESTONE: light gray, fossiliferous, well indurated.	
-					
-					
20-				SHALE: gray, silty, turning to fossiliferous limestone at 24', shell fragments, hard drilling.	
-					
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 2 of 3

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end
3/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-					
-					
-					
-					
-					
-					
25				LIMESTONE: shaly, light gray, cemented, shell fragments and pyrite.	
-					
-					
-					
-					
30				CLAY: gray, silty, fairly plastic, turn- ing to sandy clay, carbonaceous, pyrite.	
-					
-					
-					
35	SS			SAND: light gray; unconsolidated, car- bonaceous, dry, fine-grained, well sorted.	
-					
-					
-					
40				SAND: bone white, dry, unconsolidated, clay matrix, well sorted.	
-					
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 3 of 3

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end
3/20/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Taken	Graphic Log	Stratigraphy	Remarks
-					
-					
-					
-					
-					
-					
-					
45-		SS		SAND: silty, light gray, with clay matrix, unconsolidated.	
-					
-					
-					
50-				SAND: cemented, very hard, turning wet at 55', well sorted, silicic cement.	
-					
-					
-					
55-				SAND: brown, wet, fine-medium-grained, unconsolidated, quartrose. Water at 50'.	
-					
-					
-					
60-		SS		CLAY: gray-green, fairly plastic, turning to green confining clay, dry. TD: 62.5 ft.	
-					
-					
-					
--					

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 1 of 3

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end
3/17/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Taken	Graphic Log	Stratigraphy	Remarks
-				LIMESTONE: yellow-gray, fossiliferous, turning to fine sand at 4-4.5'. 25% sand, 75% limestone over 5' interval.	Walnut Formation.
-					
-					
-					
-					
-					
5-				LIMESTONE: yellow-brown, fossiliferous, with thin stringers of sand (1/4" thick).	
-					
-					
-					
-					
10-				LIMESTONE: hard, gray, shaley; shale is calcareous, fissile, strong color change. First shale at 9'. LIMESTONE: hard, shaley, well cemented.	Rig chattering.
-					
-					
-					
15-				Fossiliferous 15-18'.	
-					
-					
-					
-					
20-				SHALE (18-19'). LIMESTONE (19-20'): fossiliferous. SHALE: dark gray with limestone stringers (fossiliferous limestone), shale is fissile, soft, calcareous.	
-					
-					
-					
--					

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LOG OF DRILLING OPERATIONS

Sheet 2 of 3

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube.
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end
3/17/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

RADIAN
CORPORATION

LOG OF DRILLING OPERATIONS

Sheet 3 of 3

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube,
SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end
3/17/86 of drilling operation
Type Drill Rig and Operator CME-75,
Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample			Stratigraphy	Remarks
	Sample Zone	Type Taken	Graphic Log		
-					
-					
-					
-					
-					
-					
-					
45-				SAND: brown, fine-grained, well sorted, silicic matrix, uncemented, moist.	
-					
-					
-					
-					
-					
50-				SAND: fine-grained, well sorted, with streaks of carbonaceous material; interbedded clay 53-55', gray with hard streaks of sandstone.	Making water at 48'.
-					
-					
-					
-					
55-				SANDSTONE: hard, carbonaceous, with interbedded clay. TD: 55 ft.	Abundant water.
-					
-					
-					
-					



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Soil Boring Completion Logs

RADIAN
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BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-1 Project Air Force Plant 4 IRP
Location Fuel Saturation Area No.2 Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/24/86 Completed 1/27/86
Total Depth Drilled (ft) 22 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grouted from surface to 22 ft.
Interval of Grout (ft-ft) 0-22

SAMPLING

Number and Type of Samples Collected 4 samples from Shelby tubes
Sample Interval (ft-ft) 4-5, 9-9.3, 14-14.5, 19-19.2
Storage and/or Preservation Method(s) Samples 4-5, 14-14.5 stored in 500 ml glass
containers with Teflon lined lids at 0°C. All other samples stored in metal
containers at ambient temperatures.

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-2 Project Air Force Plant 4 IRP
Location Fuel Saturation Area No.2 Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/24/86 Completed 1/27/86
Total Depth Drilled (ft) 21 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion None (grouted from surface to total depth)
Interval of Grout (ft-ft) 0-21

SAMPLING

Number and Type of Samples Collected 6 Shelby tube samples
Sample Interval (ft-ft) 4-4.3, 5-6, 9-9.2, 10-11, 14-14.5, 19-19.2

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-3 Project Air Force Plant 4 IRP
Location Fuel Saturation Area No.2 Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/24/86 Completed 1/27/86
Total Depth Drilled (ft) 22 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling _____
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Borehole grouted to total depth
Interval of Grout (ft-ft) 0-22

SAMPLING

Number and Type of Samples Collected 3 Shelby tube and 1 split-spoon sample
Sample Interval (ft-ft) 4-4.2, 9-10, 14-14.5, 19-19.2
Storage and/or Preservation Method(s) _____

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-4 Project Air Force Plant 4 IRP
Location Fuel Saturation Area No.1 Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/24/86 Completed 1/27/86
Total Depth Drilled (ft) 28 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion None (grouted from surface to total depth)
Interval of Grout (ft-ft) 0-28

SAMPLING

Number and Type of Samples Collected 6 Shelby tube and 1 split-spoon sample
Sample Interval (ft-ft) 4-4.5, 9-10, 14-14.3, 19-20, 23-23.3, 24-24.2, 24.2-25.5
Storage and/or Preservation Method(s) _____

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-5 Project Air Force Plant 4 IRP
Location Die Yard Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/26/86 Completed 1/27/86
Total Depth Drilled (ft) 33.5 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 33.5 ft.
Interval of Grout (ft-ft) 0-33.5

SAMPLING

Number and Type of Samples Collected 6 samples from Shelby tubes
Sample Interval (ft-ft) 4-5, 9-10, 15.5-16, 19-19.4, 24-25, 29-29.5
Storage and/or Preservation Method(s) Sample 9-10 stored in a 500 ml glass container
with Teflon lined lid at 0°C. All other samples in metal containers at ambient
temperatures.

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-6 Project Air Force Plant 4 IRP
Location NARF Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/21/86 Completed 7/21/86
Total Depth Drilled (ft) 9 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 9 ft.
Interval of Grout (ft-ft) 0-9

SAMPLING

Number and Type of Samples Collected 4 samples from Shelby tubes
Sample Interval (ft-ft) 2-3, 4-5, 6-, 6-7
Storage and/or Preservation Method(s) Samples stored in glass jars

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-7 Project Air Force Plant 4 IRP
Location NARE Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/21/86 Completed 7/21/86
Total Depth Drilled (ft) 4 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 4 ft.
Interval of Grout (ft-ft) 0-4

SAMPLING

Number and Type of Samples Collected 1 sample from Shelby tube
Sample Interval (ft-ft) 2-2.5
Storage and/or Preservation Method(s) Samples stored in glass jars

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-8 Project Air Force Plant 4 IRP
Location NARF Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/21/86 Completed 7/21/86
Total Depth Drilled (ft) 5.75 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 5.75 ft.
Interval of Grout (ft-ft) 0-5.75

SAMPLING

Number and Type of Samples Collected 1 sample from Shelby tube
Sample Interval (ft-ft) 2-3
Storage and/or Preservation Method(s) Sample stored in glass jar

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-9 Project Air Force Plant 4 IRP
Location Building 21, Fuel Test Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/22/86 Completed 7/22/86
Total Depth Drilled (ft) 20.5 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 20.5 ft.
Interval of Grout (ft-ft) 0-20.5

SAMPLING

Number and Type of Samples Collected 3 samples from Shelby tube
Sample Interval (ft-ft) 2 from 9-10, 1 from 19-20
Storage and/or Preservation Method(s) Sample stored in glass jar at 0°C

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

RADIAN
CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-10 Project Air Force Plant 4 IRP
Location Building 21, Fuel Test Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/22/86 Completed 7/22/86
Total Depth Drilled (ft) 29.5 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 19.5 ft.
Interval of Grout (ft-ft) 0-19.5

SAMPLING

Number and Type of Samples Collected 2 samples from Shelby tube
Sample Interval (ft-ft) 9-10
Storage and/or Preservation Method(s) Sample stored in glass jar at 0°C

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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BOREHOLE COMPLETION LOG: SHEET 11

Borehole No. SB-11 Project Air Force Plant 4 IRP
Location NARF Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/24/86 Completed 7/24/86
Total Depth Drilled (ft) 4.75 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 4.75 ft.
Interval of Grout (ft-ft) 0-4.75

SAMPLING

Number and Type of Samples Collected 2 samples from Shelby tube; 1 from split-spoon
Sample Interval (ft-ft) 2-3 (2 samples), 4-4.5
Storage and/or Preservation Method(s) Sample stored in glass jar

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level

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CORPORATION

BOREHOLE COMPLETION LOG: SHEET 1/1

Borehole No. SB-12 Project Air Force Plant 4 IRP
Location NARF Area Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 7/24/86 Completed 7/24/86
Total Depth Drilled (ft) 1.5 Hole Diameter 8 inch
Drilling Method Hollow-Stem Auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 Potable Supply

COMPLETION

Type of Completion Grout from surface to 1.5 ft.
Interval of Grout (ft-ft) 0-1.5

SAMPLING

Number and Type of Samples Collected None
Sample Interval (ft-ft) _____
Storage and/or Preservation Method(s) _____

MATERIALS

Type of Grout Lonestar Portland Cement Source Maryneal, TX

COMMENTS

BGL - below ground level



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Well Completion Logs



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MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-100
Location Former Fuel Storage Area
Elevation (surface) 670.43
Elevation (measuring pt.) 670.10

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/20/86 Completed 1/22/86
Total Depth Drilled (ft) 49 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 33.5
Screen Interval (ft-ft) 33.5-48.5

Interval of Grout (ft-ft) 1.0-27.5
Interval of Bentonite (ft-ft) 27.5-29.5
Interval of Sand Pack (ft-ft) 29.5-35.5 Slough 35.5-49.0

SAMPLING

Number and Type of Samples Collected 5 samples from continuous core barrel
Sample Interval (ft-ft) 7-7.5, 11-12, 24.5-25, 25-26, 35-36, 47-48
Storage and/or Preservation Method(s) Samples 11-12, 25-26, 35-36 stored in 500 ml
glass containers with Teflon lined lids at 0°C. All others stored in metal con-
tainers at ambient temperatures.

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 9 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 2 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-100
Location Former Fuel Storage Area

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

DEVELOPMENT

Development started 1/22/86 and ended 1/26/86.

Static water level before development 35.5 (ft) and after development 38.3 (ft).

Depth of open hole inside well before development 47 (ft) and after development - (ft).

Water quantity discharged during development 6.6 (ft³).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC hand pump

COMMENTS

BGL (below ground level); ID (internal diameter)

Development Record of Discharge and Sediment

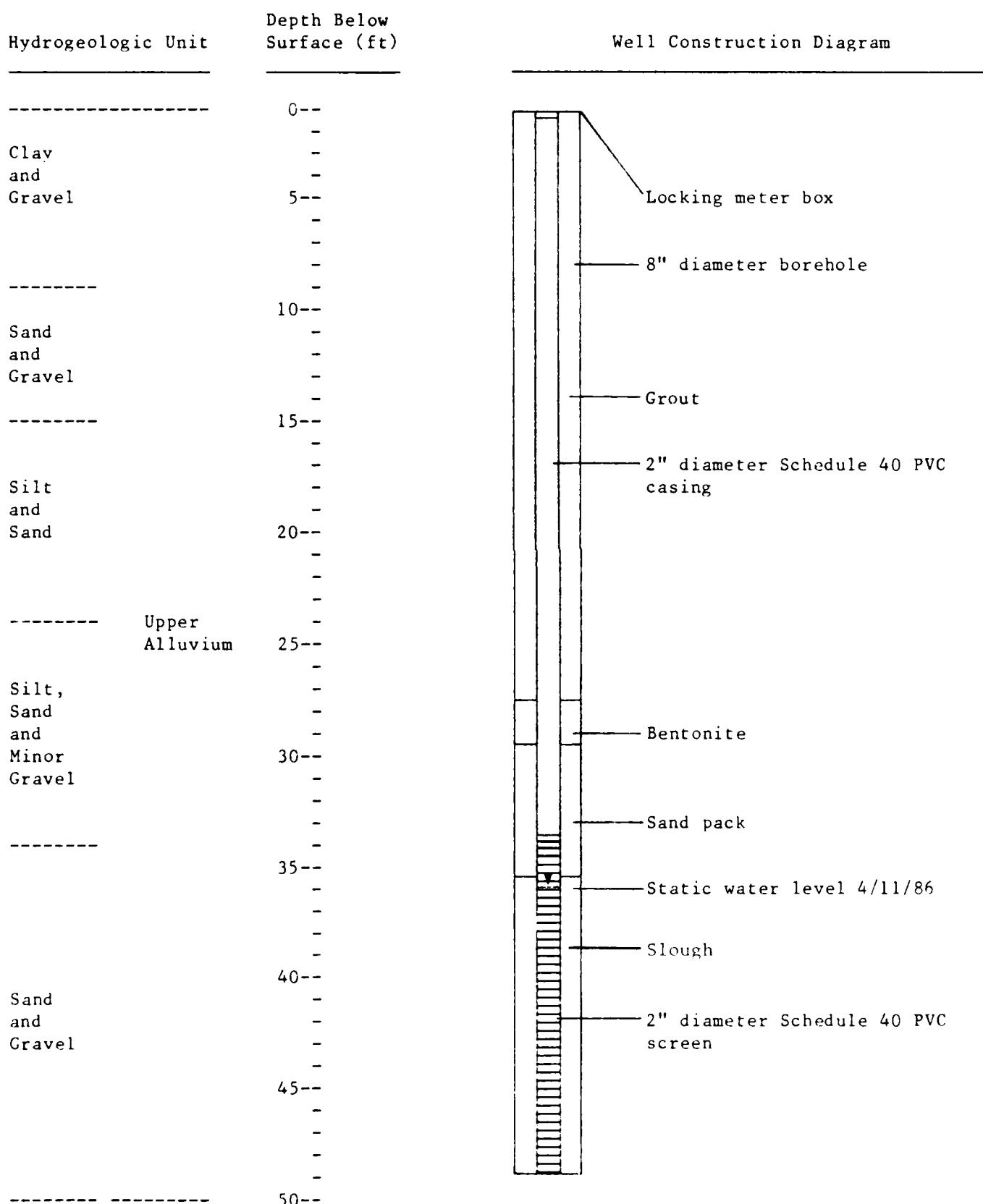
Date	Time	Clar/Clr. Discharge	Odor of Discharge	Lithology/ Grain Size	pH	Conduc- tivity	Temp.	Remarks
1/22	1710	Brown; clearer after 2 gal.	-	Clay/silt				
	1740		Having problem with pump, pulled approx. 2 gals. total					
1/23	1035	Brown	-	Clay/silt v.f. sand	7.1	800	15 °C	2 gal. total
	1435	Murky	-	As above	7.0	900	18 °C	1 gal.
	1540	Clearer	-	Silt/ v.f.sd	6.8	800	18 °C	2 gal.
1/24	1630	Murky	-	"	7.0	900	19 °C	1 gal.
	1635	Murky	-	"	7.0	900	19 °C	2 gal.
1/25	0943	Murky	-	"	6.5	900	18 °C	1 gal.
	0946	Murky	-	"	6.5	900	18 °C	2 gal.
	1150	Murky	-	v.f. sand	6.5	900	19 °C	1 gal.
	1406	Clear	-	less sand	6.3	900	19 °C	1 gal.
	1432	Clear	-	"	6.8	900	18 °C	8 gal/26 min.
1/26	1518	Cloudy tan	-	fine sand silt	7.3	1000	19 °C	1 gal.
	1631	Cloudy tan	-	"	7.4	900	17 °C	20 gal/73 min.

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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-100
Location Former Fuel Storage Area

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-101
Location FDTA No.3 Area
Elevation (surface) 665.32
Elevation (measuring pt.) 664.99

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/21/86 Completed 1/26/86
Total Depth Drilled (ft) 34 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 19
Screen Interval (ft-ft) 19-34

Interval of Grout (ft-ft) 1-14
Interval of Bentonite (ft-ft) 14-16
Interval of Sand Pack (ft-ft) 16-26 Slough 26-34

SAMPLING

Number and Type of Samples Collected 6 samples from Shelby tubes
Sample Interval (ft-ft) 4-5, 9-10, 14-15, 19-20, 24-25, 29-30
Storage and/or Preservation Method(s) All samples stored in metal containers at ambient temperature

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 6 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 4.5 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

Boring or Well No. HM-101
Location FDTA No.3 AreaProject Air Force Plant 4 IRP
Log Recorded by Peter A. WaterreusDEVELOPMENTDevelopment started 1/25/86 and ended 1/25/86.Static water level before development 22.2 (ft) and after development 22.2 (ft).Depth of open hole inside well before development 30.9 (ft) and after development 31.5 (ft).Water quantity discharged during development 21.4 (ft³).Type, size/capacity of pump or bailer used for development Brainard Kilman i.7 PVC hand pumpCOMMENTSBGL (below ground level): ID (internal diameter)Development Record of Discharge and Sediment

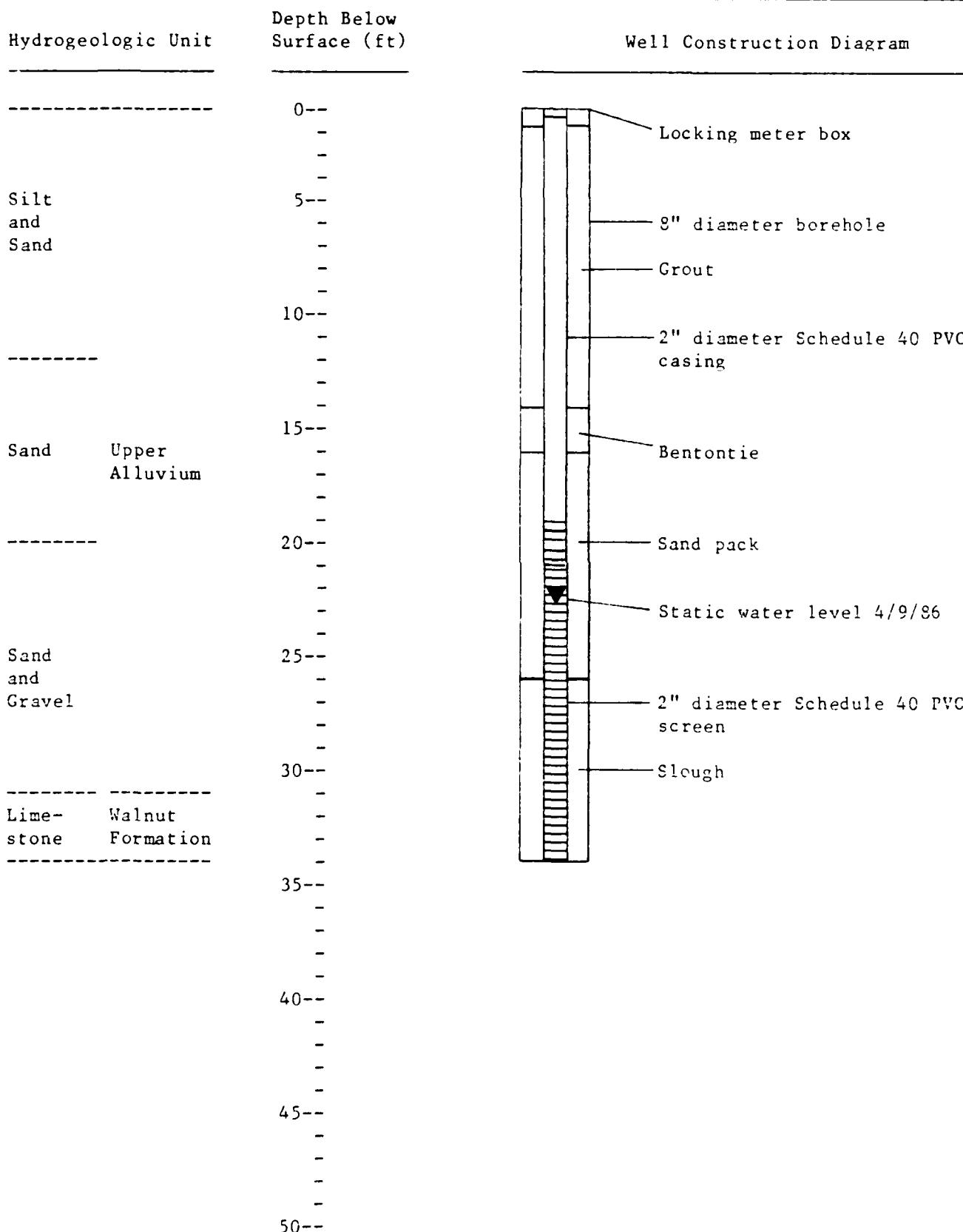
<u>Time</u>	<u>Clar/Clr. Discharge</u>	<u>Odor of Discharge</u>	<u>Lithology/ Grain Size</u>	<u>pH</u>	<u>Conduc- tivity</u>	<u>Temp.</u>	<u>Remarks</u>
1023	Brownish gray	None	v.f. sand, clay	6.6	800	18°C	Oily looking; 1 gal.
1056	Less murky	None	less v.f. sand	6.5	750	20°C	No film; 40 gals. since start
1114	Getting clearer	None	little sand	6.5	700	20°C	100 gals.; no film
1134	Getting clearer	None	less sand	6.5	750	19°C	apx. 60 gals. since start, no film

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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-101
Location FDTA No.3 Area

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-102
Location Landfill No.2 Area
Elevation (surface) 654.98
Elevation (measuring pt.) 654.65

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/21/86 Completed 1/27/86
Total Depth Drilled (ft) 44 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 14
Screen Interval (ft-ft) 14-44

Interval of Grout (ft-ft) 1-11
Interval of Bentonite (ft-ft) 11-13
Interval of Sand Pack (ft-ft) 13-44

SAMPLING

Number and Type of Samples Collected 3 samples from Shelby tubes and 2 samples from split spoons
Sample Interval (ft-ft) 5.5-6.5, 9-9.3, 14-14.5, 19-19.5, 34-43.1
Storage and/or Preservation Method(s) All samples stored in metal containers at ambient temperatures

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 2 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. sacks Source TX Mining Co., Arlington, TX
Amount 9 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-102
Location Landfill No.2 Area

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

DEVELOPMENT

Development started - and ended -.

Static water level before development - (ft) and after development - (ft).

Depth of open hole inside well before development - (ft) and after
development - (ft).

Water quantity discharged during development - (ft^3).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

BGL (below ground level); ID (internal diameter)

RADIAN
CORPORATION

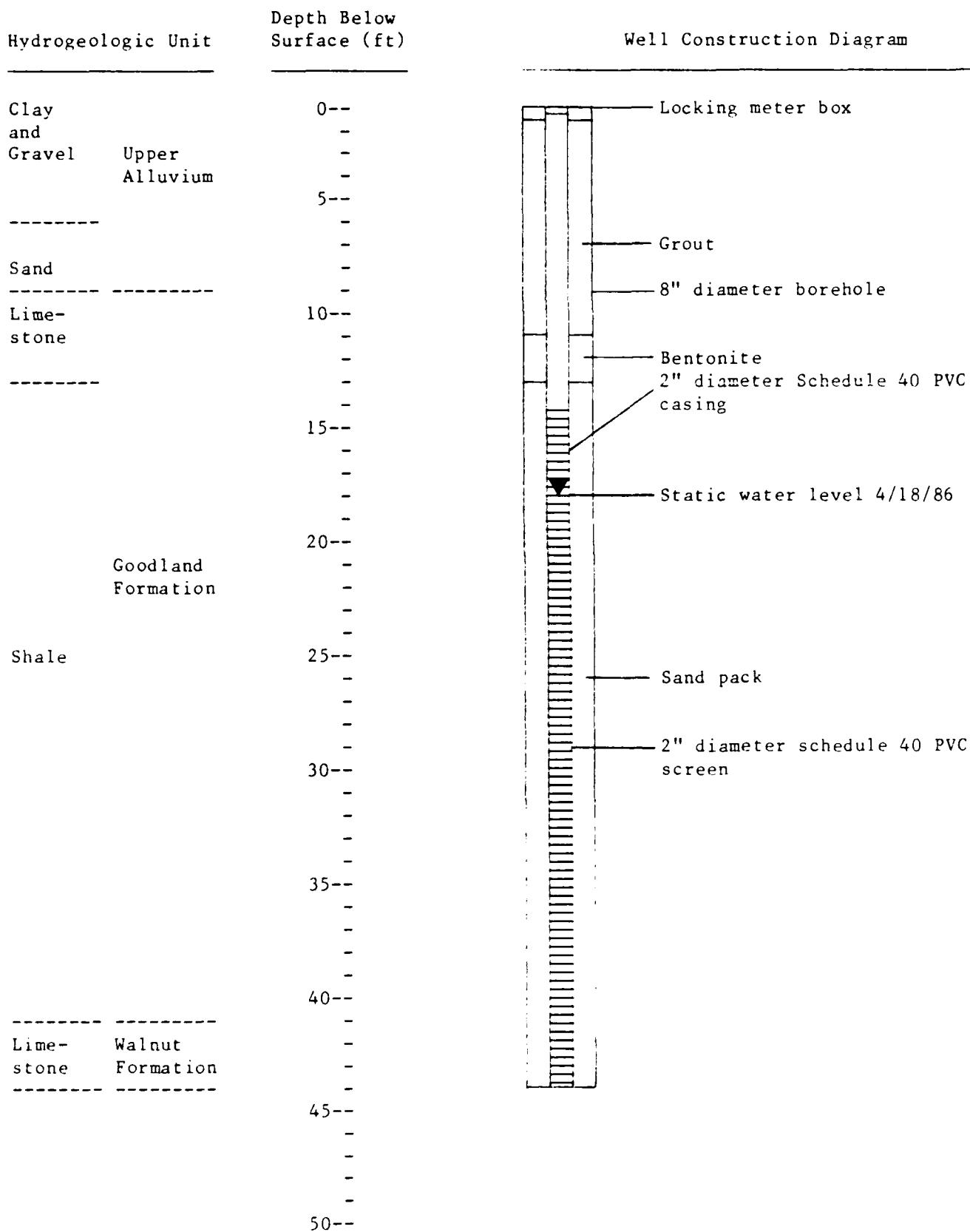
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-102

Location Landfill No.2 Area

Project Air Force Plant 4 IRP

Log Recorded by Peter A. Waterreus



RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-103
Location NE Corner/Bldg. 188 Chrome Pit 1
Elevation (surface) 648.61
Elevation (measuring pt.) 648.28

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/21/86 Completed 1/26/86
Total Depth Drilled (ft) 39 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 29
Screen Interval (ft-ft) 29-39

Interval of Grout (ft-ft) 1-24.7
Interval of Bentonite (ft-ft) 24.7-27
Interval of Sand Pack (ft-ft) 27-38 Slough 38-39

SAMPLING

Number and Type of Samples Collected 7 samples from Shelby tubes and 1 samples from a split-spoon
Sample Interval (ft-ft) 4-5, 9-10, 14-15, 19-20, 24-25, 29-30, 34-35, 39-39, 19-19.02
Storage and/or Preservation Method(s) Samples 29-30, 34-35 stored in 500 ml glass containers with Teflon lined lids at 0°C, All others stored in metal containers at ambient temperatures.

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 10 sacks

Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket

Type of Sand Pack No. 1A Blastsand, 100 lb. sacks Source TX Mining Co., Arlington, TX
Amount 3 sacks

Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-103
Location NE Corner/Bldg. 188 Chrome Pit 1

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

DEVELOPMENT

Development started 1/25/86 and ended 1/25/86.

Static water level before development 24.33 (ft) and after development 24.25 (ft).

Depth of open hole inside well before development 38.0 (ft) and after development 38.2 (ft).

Water quantity discharged during development 16 (ft³).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC hand pump

COMMENTS

BGL (below ground level); ID (internal diameter)

Development Record of Discharge and Sediment

Time	Clar/Clr. Discharge	Odor of Discharge	Lithology/ Grain Size	pH	Conduc- tivity	Temp.	Remarks
1347	Tan, murky	None	v.f. fine sand and silt	6.5	900	20°C	5 gal.
1409	Getting a bit cleaner	None	"	6.5	800	21°C	25 gal. since start
1426	Getting clearer	None	less silt and sand	6.5	800	21°C	70 gal. since start
1445	Cloudy (tan)	None	"	6.5	800	21°C	120 gal.

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-103
Location NE Corner/Bldg. 188 Chrome Pit 1

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-104 Project Air Force Plant 4 IRP
Location SW Corner of Bldg. 188 Log Recorded by Peter A. Waterreus

DEVELOPMENT

Development started ____ and ended ____.

Static water level before development ____ (ft) and after development ____ (ft).

Depth of open hole inside well before development ____ (ft) and after
development ____ (ft).

Water quantity discharged during development ____ (ft^3).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

BGL (below ground level); ID (internal diameter)

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-104
Location SW Corner of Bldg. 188
Elevation (surface) 650.04
Elevation (measuring pt.) 649.71

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/22/86 Completed 1/27/86
Total Depth Drilled (ft) 39 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 23.5
Screen Interval (ft-ft) 23.5-38.5 Slough 38.5-39

Interval of Grout (ft-ft) 1-17.4
Interval of Bentonite (ft-ft) 17.4-19.8
Interval of Sand Pack (ft-ft) 19.8-35.8 Slough 35.8-39

SAMPLING

Number and Type of Samples Collected 3 samples from Shelby tubes and 5 samples from split spoons
Sample Interval (ft-ft) 4-5, 9-10, 14-15, 19-19.2, 24-24.9, 29-29.1, 34-34.04
Storage and/or Preservation Method(s) Sample 24-24.9 stored in a 500 ml glass container with Teflon lined lid at 0°C. All other samples stored in metal containers at ambient temperatures

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 4 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 4 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

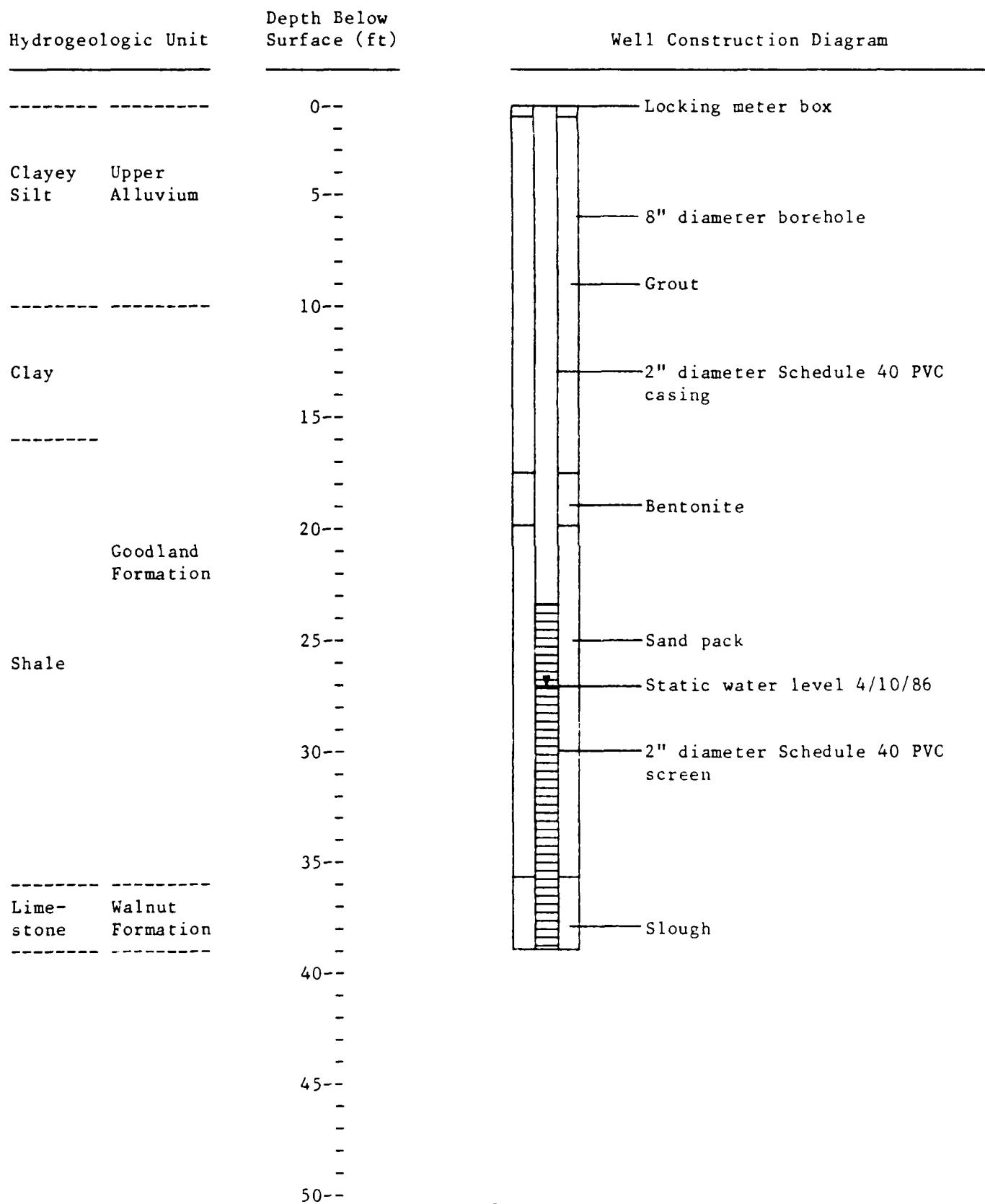
Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-104
Location SW Corner of Bldg. 188

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-105
Location Bldg. 21, Fuel Test Area
Elevation (surface) 642.25
Elevation (measuring pt.) 641.92

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 8/11/86 Completed 8/12/86
Total Depth Drilled (ft) 21 Hole Diameter 8-inch
Drilling Method Hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33-1.83 Depth (ft) 20.5
Screen Interval (ft-ft) 5.5-20.5

Interval of Grout (ft-ft) 0.33-1.83
Interval of Bentonite (ft-ft) 1.83-4
Interval of Sand Pack (ft-ft) 4-21

SAMPLING

Number and Type of Samples Collected 2 soil samples
Sample Interval (ft-ft) 18.5
Storage and/or Preservation Method(s) Glass jar, frozen

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 4 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-105 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Toby Walters

DEVELOPMENT

Development started 8/13/86 and ended 8/13/86.

Static water level before development - (ft) and after development - (ft).

Depth of open hole inside well before development - (ft) and after
development - (ft).

Water quantity discharged during development - (ft^3).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

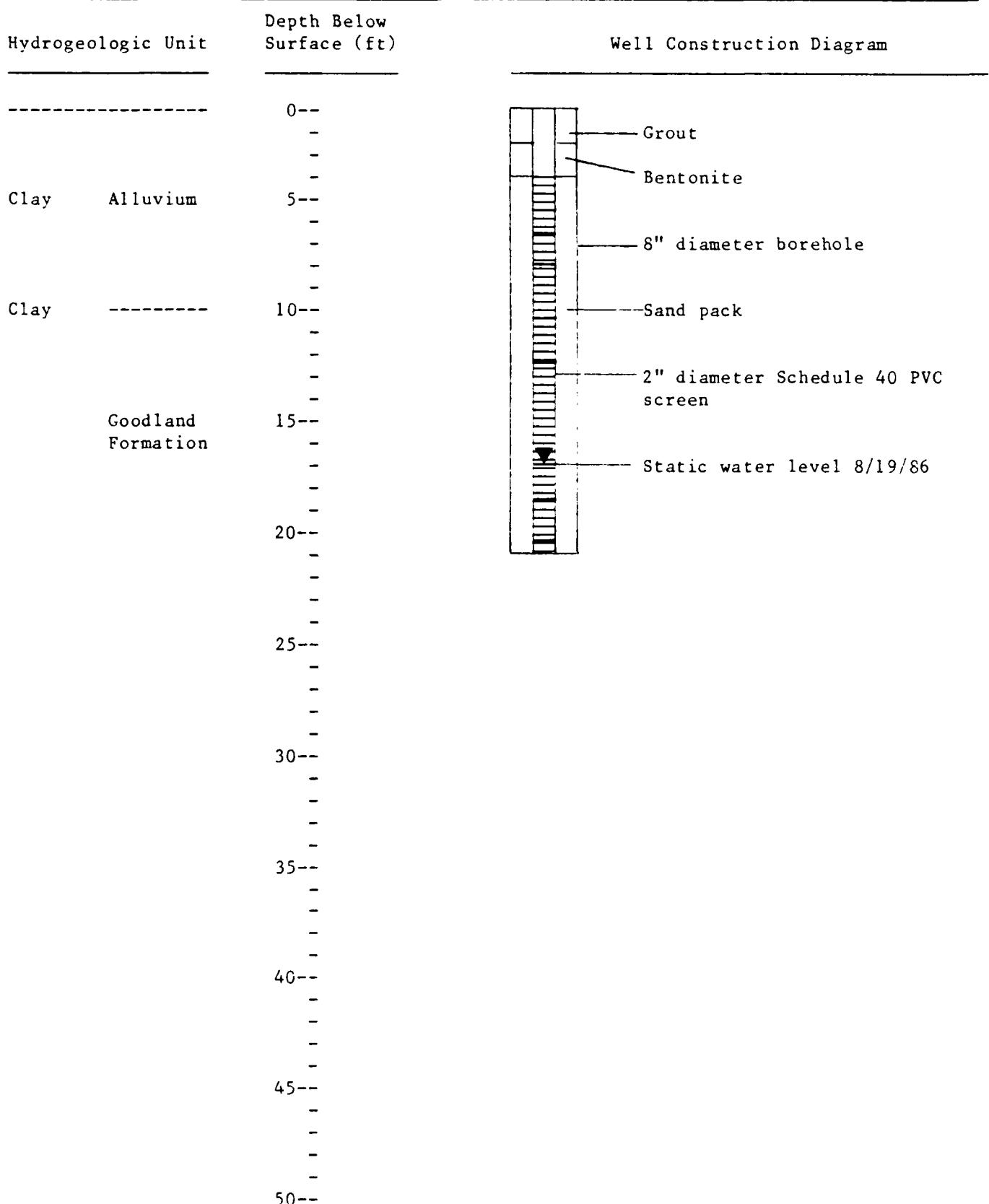
BGL (below ground level); ID (internal diameter)

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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-105
Location Bldg. 21, Fuel Test Area

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-106
Location NW Corner of Solvent Line
Elevation (surface) 650.09
Elevation (measuring pt.) 649.76

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Southwestern Laboratories

CONSTRUCTION

Construction Started 1/26/86 Completed 1/27/86
Total Depth Drilled (ft) 34 Hole Diameter 8-inch
Drilling Method hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Flush with ground surface
Top of Well Casing (ft) 0.33 BGL Depth (ft) 15.1
Screen Interval (ft-ft) 15.1-30.1 Slough 30.1-34

Interval of Grout (ft-ft) 1-12
Interval of Bentonite (ft-ft) 12-14.3
Interval of Sand Pack (ft-ft) 14.3-30.1 Slough 30.1-34

SAMPLING

Number and Type of Samples Collected 5 samples from Shelby tubes and 1 sample from a split-spoon
Sample Interval (ft-ft) 4-5, 9-9.5, 14-15, 19-19.3, 24-24.5, 29-29.1
Storage and/or Preservation Method(s) Samples 9-9.5, 19-19.3, 24-24.5 stored in 500 ml glass containers with Teflon lined lids at 0°C. All other samples stored in metal containers at ambient temperatures.

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.01
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 2 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. sacks Source TX Mining Co., Arlington, TX
Amount 3 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-106 Project Air Force Plant 4 IRP
Location NW Corner of Solvent Line Log Recorded by Peter A. Waterreus

DEVELOPMENT

Development started - and ended -.

Static water level before development - (ft) and after development - (ft).

Depth of open hole inside well before development - (ft) and after
development - (ft).

Water quantity discharged during development - (ft^3).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

BGL (below ground level); ID (internal diameter)

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-106
Location NW Corner of Solvent Lin

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-107
Location Bldg. 21 Fuel Test Area
Elevation (surface) 638.71
Elevation (measuring pt.) 642.33

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 8/12/86 Completed 8/12/86
Total Depth Drilled (ft) 23 Hole Diameter 8-inch
Drilling Method Hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground
Top of Well Casing (ft) 3.62 AGL Depth (ft) 23.35
Screen Interval (ft-ft) 7.5-22.5

Interval of Grout (ft-ft) 0-4.3
Interval of Bentonite (ft-ft) 4.3-6.5
Interval of Sand Pack (ft-ft) 6.5-22.5, 22.5-23 slough

SAMPLING

Number and Type of Samples Collected 2 soil samples
Sample Interval (ft-ft) 14-15
Storage and/or Preservation Method(s) Glass jars, frozen

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount 2 sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 4 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-107 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Toby Walters

DEVELOPMENT

Development started 8/13/86 and ended 8/13/86.

Static water level before development 13.13 (ft) and after development - (ft).
Depth of open hole inside well before development 25.35 (ft) and after
development 25.35 (ft).

Water quantity discharged during development 1.07 (ft^3).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

BGL (below ground level): ID (internal diameter)

Development Record of Discharge and Sediment

Time	Clar/Clr. <u>Discharge</u>	Odor of <u>Discharge</u>	Lithology/ <u>Grain Size</u>	pH	Conduc- tivity	Remarks
1720	Murky	None	-	-	-	Several pump strokes, then cleared up, went dry after apx. 8 gal.

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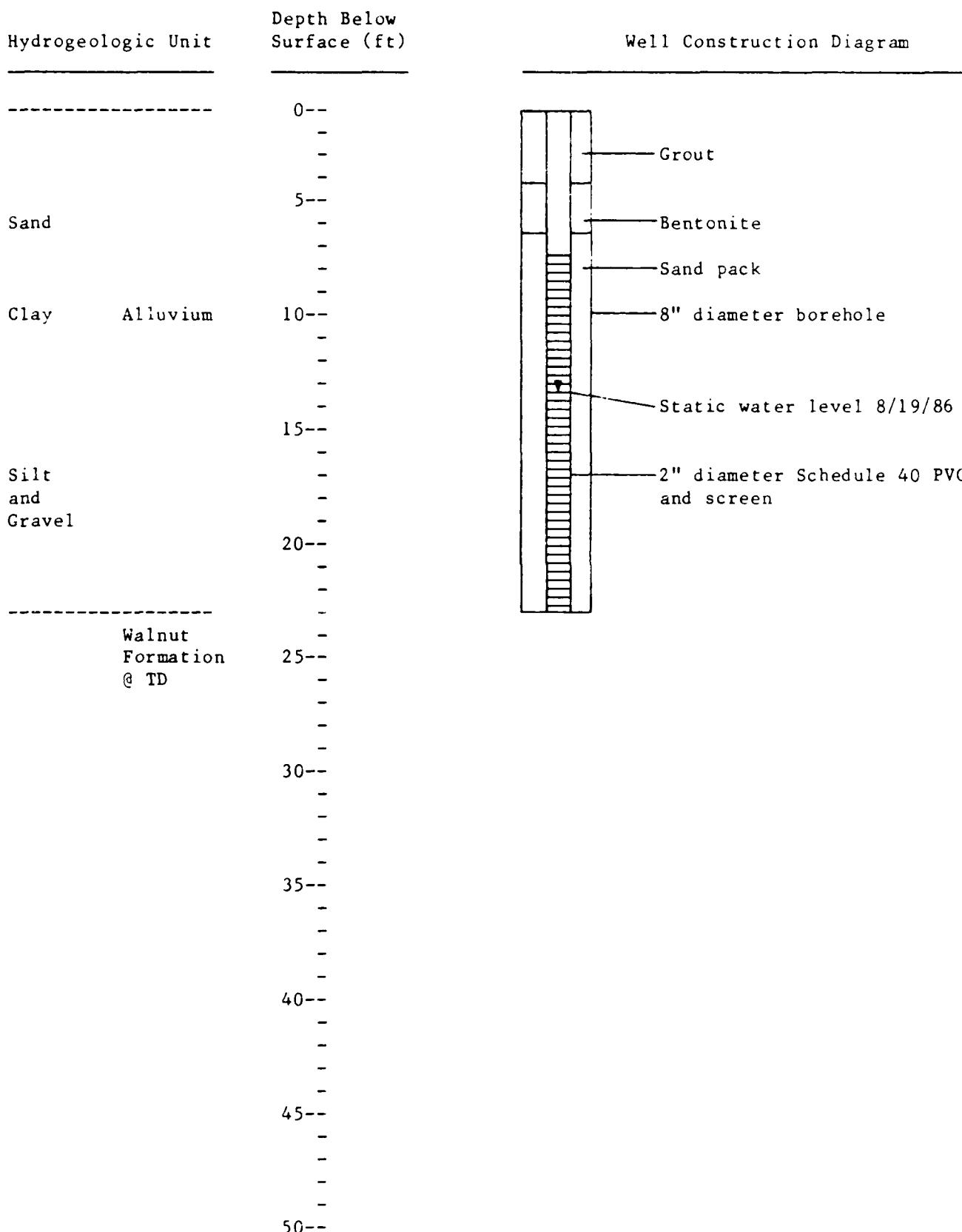
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-107

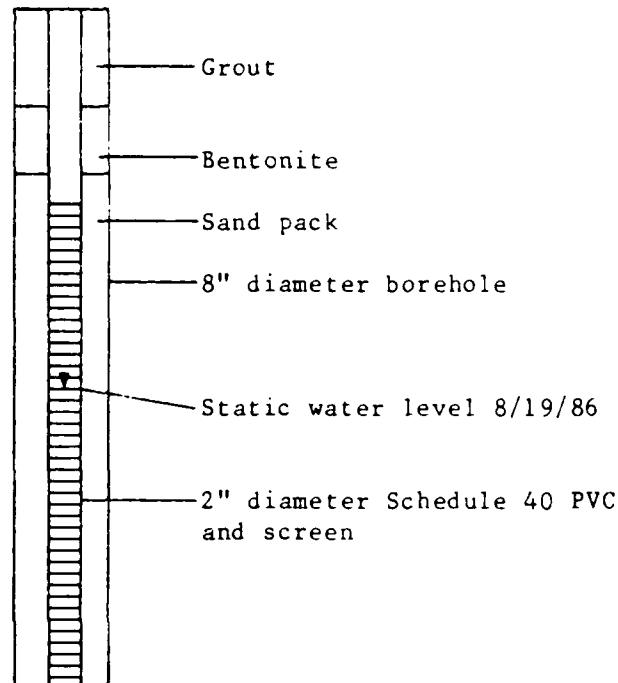
Location Bldg. 21, Fuel Test Area

Project Air Force Plant 4 IRP

Log Recorded by Peter A. Waterreus



Well Construction Diagram



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MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. HM-108
Location Bldg. 21, Fuel Test Area
Elevation (surface) 636.93
Elevation (measuring pt.) 639.76

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 8/12/86 Completed 8/12/86
Total Depth Drilled (ft) 15 Hole Diameter 8-inch
Drilling Method Hollow-stem auger
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground
Top of Well Casing (ft) 2.83 AGL Depth (ft) 15
Screen Interval (ft-ft) 5-15

Interval of Grout (ft-ft) 0-2
Interval of Bentonite (ft-ft) 2-4
Interval of Sand Pack (ft-ft) 4-15

SAMPLING

Number and Type of Samples Collected 2 soil samples
Sample Interval (ft-ft) 9-10
Storage and/or Preservation Method(s) Glass jars, frozen

MATERIALS

Casing Type 2-inch ID Schedule 40 PVC
Screen Type 2-inch ID Schedule 40 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

Type of Grout Lonestar Portland Cement Source Maryneal, TX
Type I, 94 lb. sacks Amount sacks
Type of Bentonite Pellets, 50 lb. buckets Source Economy Mud Prod., Houston, TX
Amount 1 bucket
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 3 sacls
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking meter box

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. HM-108 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Toby Walters

DEVELOPMENT

Development started 8/13/86 and ended 8/13/86.

Static water level before development 14.37 (ft) and after development 14.37 (ft).

Depth of open hole inside well before development 14.89 (ft) and after
development 14.89 (ft).

Water quantity discharged during development - (ft³).

Type, size/capacity of pump or bailer used for development Brainard Kilman 1.7 PVC
hand pump

COMMENTS

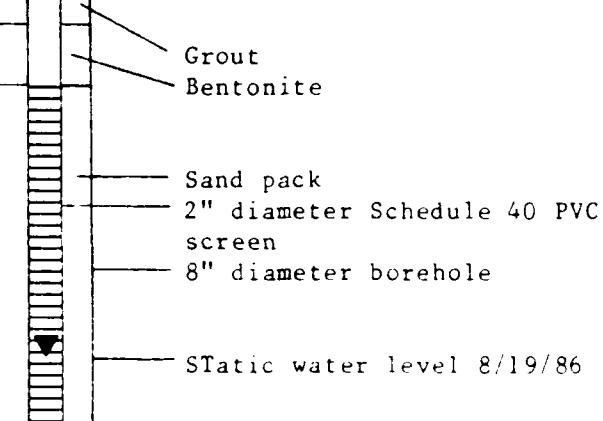
BGL (below ground level); ID (internal diameter)

Couldn't develop due to small amount of water in well.

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MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-108 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit	Depth Below Surface (ft)	Well Construction Diagram
	0--	
	-	
	-	
Clayey Sand and Gravel	5--	
	-	
	-	
	-	
	-	
Clay Alluvium	10--	
	-	
	-	
	-	
	-	
	-	
Walnut Formation @ TD	15--	
	-	
	-	
	-	
	-	
	20--	
	-	
	-	
	-	
	-	
	25--	
	-	
	-	
	-	
	-	
	30--	
	-	
	-	
	-	
	-	
	35--	
	-	
	-	
	-	
	-	
	40--	
	-	
	-	
	-	
	-	
	45--	
	-	
	-	
	-	
	-	
	50--	

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CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. P-20m
Location Radar Range, S. of Landfill No.4
Elevation (surface)
Elevation (measuring pt.) 673.23 ft.

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 2/25/86 Completed 3/05/86
Total Depth Drilled (ft) 155' Hole Diameter 20" (0-41.3) 15"
Drilling Method Mud rotary (41.75) and 10" (75-155)
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground, 1/2 hp submersible pump
Top of Well Casing (ft) apx. 4" AGL Depth (ft) 155
Screen Interval (ft-ft) 125-155

Interval of Grout (ft-ft) 75-109.5 (5" PVC); 0-41.3 (16" steel casing)
Interval of Bentonite (ft-ft) 109.5-112.5
Interval of Sand Pack (ft-ft) 6-75, 112.5-155

MATERIALS

Casing Type 16" (ID) steel surface; 10 3/4" (ID) steel; 5" (ID) Schedule 80 PVC
Screen Type 5" (ID) Schedule 80 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

*Type of Grout TXI Portland Cement Source Midlothian, TX
Type I, 94 lb. sacks Amount 10 sacks
*Type of Sand Pack No. 1A Blastsand, 100 lb, Source TX Mining Co., Arlington, TX
sacks Amount 18 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking box over well (1/4" thick) with 3 protective posts cemented
into surface, radially 3' from well.

COMMENTS

Drilled 0-41.3 ft. with 20" bit, set 16" steel surface casing (0-41.3 ft), grout.
Drilled 0-41.3 ft. through shoe, then 41.3-75 ft. with 15" bit, set 10 3/4" steel
casing.
Drilled (0-75 ft), grout 0-75' through shoe, then 75-155 ft with 10" bit, set 5" PC
casing (0-155 ft), sand pack 112.5-155, bentonite seal 109.5-112.5, grout 75-109.5,
sand pack 6-75 ft, grout 0-6 ft.
*Materials for 5" PVC casing completion.

Boring or Well No. P-20m Project Air Force Plant 4 IRP
Location Radar Range, S. of Landfill 4 Log Recorded by Toby Walters

DEVELOPMENT

Development started 3/22/86 and ended 3/22/86.

Static water level before development 108 (ft) and after development 108 (ft).

Depth of open hole inside well before development 155 (ft) and after development 155 (ft).

Water quantity discharged during development 30 (ft^3).

Type, size/capacity of pump or bailer used for development 1" tremmie line with air compressor capacity of well: 5 gpm

COMMENTS

b.L (below ground level); ID (internal diameter)

Development Record of Discharge and Sediment

Time	Clar/Clr. <u>Discharge</u>	Odor of <u>Discharge</u>	Lithology/ <u>Grain Size</u>	pH	Conduc- <u>tivity</u>	Remarks
1425	Milky	None	Silt	-	-	Turned on compressor
1510	Clear	None	Tr. silt	-	-	Turned off compressor

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

Hydrogeologic Unit	Depth Below Surface (ft)	Well Construction Diagram
	0--	
	-	
	-	
Goodland Shale Formation	20--	
	-	
	-	
	-	
	-	
	40--	
	-	
	-	
Shale Walnut and Formation	60--	
Lime-stone	-	
	-	
	-	
	80--	
	-	
Sandstone and Sand	100--	
	-	
	-	
Clayey Paluxy Sand & Formation	120--	
Claystone	-	
	-	
	-	
Sand-stone and Stone	140--	
	-	
	-	
	160--	
	-	
	-	
	-	
	180--	
	-	
	-	
	-	
	200--	

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. P-21u
Location Radar Range, Landfill No. 2
Elevation (surface) 660.66
Elevation (measuring pt.) 660.99

Project Air Force Plant 4 IRP
Log Recorded By Peter A. Waterreus
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 2/25/86 Completed 3/10/86
Total Depth Drilled (ft) 110 Hole Diameter 20" (0-40'): 15"
Drilling Method Mud rotary (40-75') and 10" (75-110')
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground, 1/2 hp submersible pump
Top of Well Casing (ft) apx. 4" AGL Depth (ft) 110
Screen Interval (ft-ft) 85-105

Interval of Grout (ft-ft) 0-40 (16" casing); 0-75' (10 3/4" casing); 0-10' (5" PVC)
Interval of Bentonite (ft-ft) NA
Interval of Sand Pack (ft-ft) 10-110

MATERIALS

Casing Type 16" (ID) steel surface; 10 3/4" (ID) steel; 5" (ID) Schedule 80 PVC
Screen Type 5" (ID) Schedule 80 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

*Type of Sand Pack No. 1A Blastsand, 100 lb. sacks Source TX Mining Co., Arlington, TX
Amount 32 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking box over well (1/4" thick) with 3 protective posts cemented into surface, radially 3' from well.

COMMENTS

Drill 0-40' with 20: bit, set 16" steel surface casing (0-40'), grout 0-40'.
Drill out shoe, drill 15" hole (40-75'), set 10 3/4" steel casing (0-75'), grout 0-75'.
Drill out shoe, drill 10" hole (75-110'), set 5" PVC casing (0-110'), set centralizer at 100', sand pack 10-110', grout 0-10'.
*Materials for 5" PVC casing completion.

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MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. P-2lu
Location Radar Range, Landfill No. 2

Project Air Force Plant 4 IRP
Log Recorded by Toby Walters

DEVELOPMENT

Development started 3/22/86 and ended 3/22/86.

Static water level before development 90.0 (ft) and after development dry (ft).

Depth of open hole inside well before development 105 (ft) and after development 105 (ft).

Water quantity discharged during development 3.3 (ft³).

Type, size/capacity of pump or bailer used for development 1" tremmie line with air compressor capacity of well: 5 gpm

COMMENTS

BGL (below ground level); ID (internal diameter)

Development Record of Discharge and Sediment

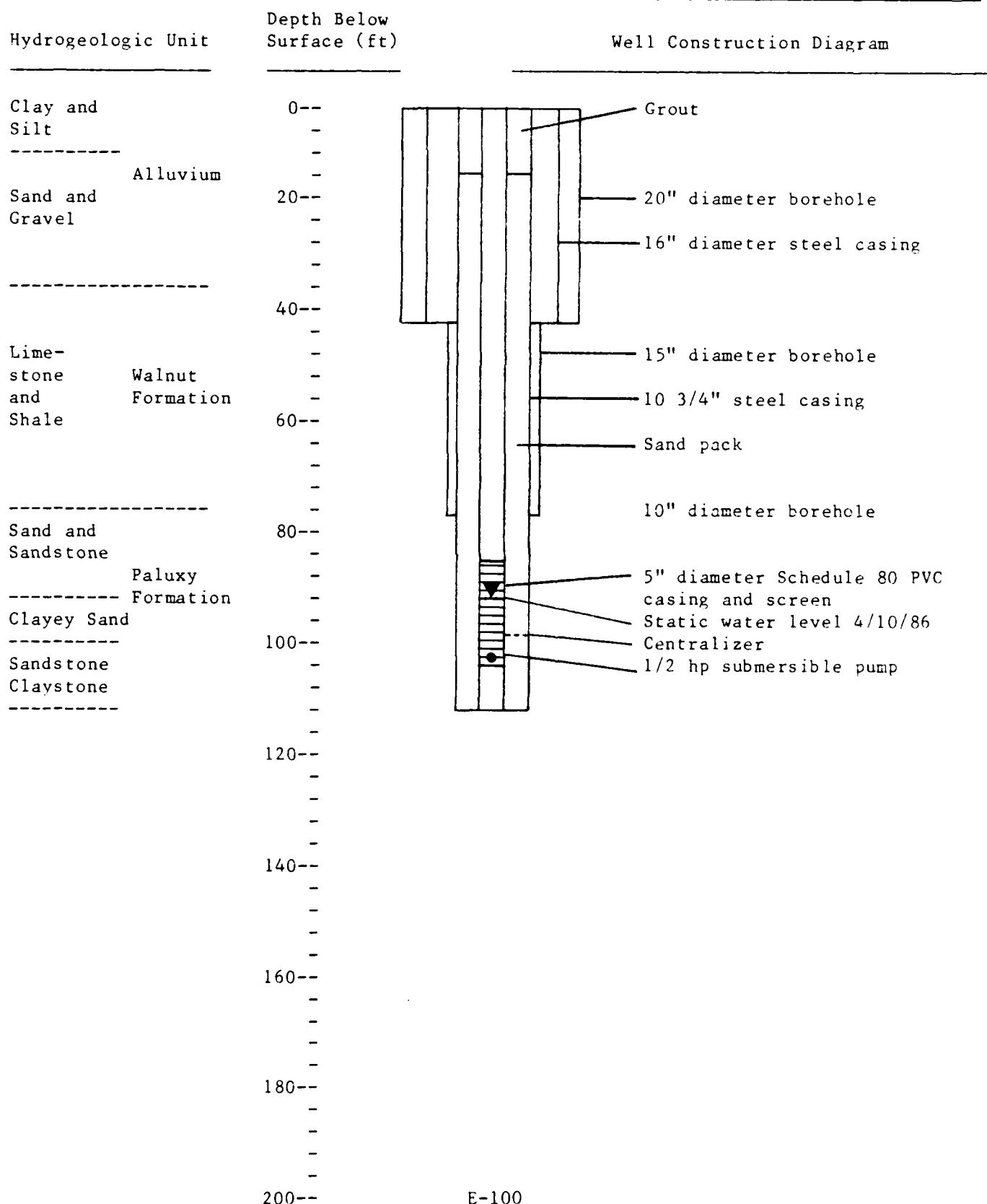
Time	Clar/Clr. <u>Discharge</u>	Odor of <u>Discharge</u>	Lithology/ <u>Grain Size</u>	pH	Conduc- tivity	Remarks
1500	Clear	None	Silt	-	-	Ran pump 4 minutes, went dry
1540	Clear	None	Silt	-	-	Turned pump on, ran 1 minute, went dry

RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-2lu
Location Radar Range, Landfill No. 2

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



RADIAN
CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. P-22u
Location Landfill No. 3
Elevation (surface)
Elevation (measuring pt.) 631.98 ft.

Project Air Force Plant 4 IRP
Log Recorded By Toby K. Walters
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 3/18/86 Completed 3/21/86
Total Depth Drilled (ft) 62.75 Hole Diameter 20" (0-9'); 15"
Drilling Method Mud rotary (9-35.3') and 10" (35.3-62.75')
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground, 1/2 hp submersible pump
Top of Well Casing (ft) apx. 4" AGL Depth (ft) 62.75
Screen Interval (ft-ft) 47.75-62.75

Interval of Grout (ft-ft) 0-9' (16" casing); 0-35.3 (10 3/4" casing); 0-10.5' (5" PVC)
Interval of Bentonite (ft-ft) NA
Interval of Sand Pack (ft-ft) 10.5-62.75

MATERIALS

Casing Type 16" (ID) steel surface; 10 3/4" (ID) steel; 5" (ID) Schedule 80 PVC
Screen Type 5" (ID) Schedule 80 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

*Type of Grout Portland Cement Source Midlothian, TX TXI
Type I, 94 lb. sacks Amount 22 sacks 180 gallons
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 21 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking box over well (1/4" thick) with 3 protective posts cemented
into surface, radially 3' from well.

COMMENTS

Drilled 0-9' with 20" bit, set 16" steel surface casing (0-9'), grout 0-9'.
Drilled out shoe, drill 15" hole (9-35.3'), set 10 3/4" steel casing (9-35.2'), grout 0-35.3'.
Drill out shoe, drill 10" hole (35.3-62.75'), set 5" PVC casing (0-62.75'), sand pack 10.5-62.75', grout 0-10.5'.
*Materials for 5" PVC casing completion.

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MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. P-22u Project Air Force Plant 4 IRP
Location Landfill No. 3 Log Recorded by Toby Walters

DEVELOPMENT

Development started 3/20/86 and ended 3/20/86.

Static water level before development 57 (ft) and after development 57 (ft).

Depth of open hole inside well before development 62.75 (ft) and after development 62.75 (ft).

Water quantity discharged during development 70 (ft^3).

Type, size/capacity of pump or bailer used for development 1" tremmie line with air compressor capacity of well: 5 gpm

COMMENTS

BGL (below ground level): ID (internal diameter)

Development Record of Discharge and Sediment

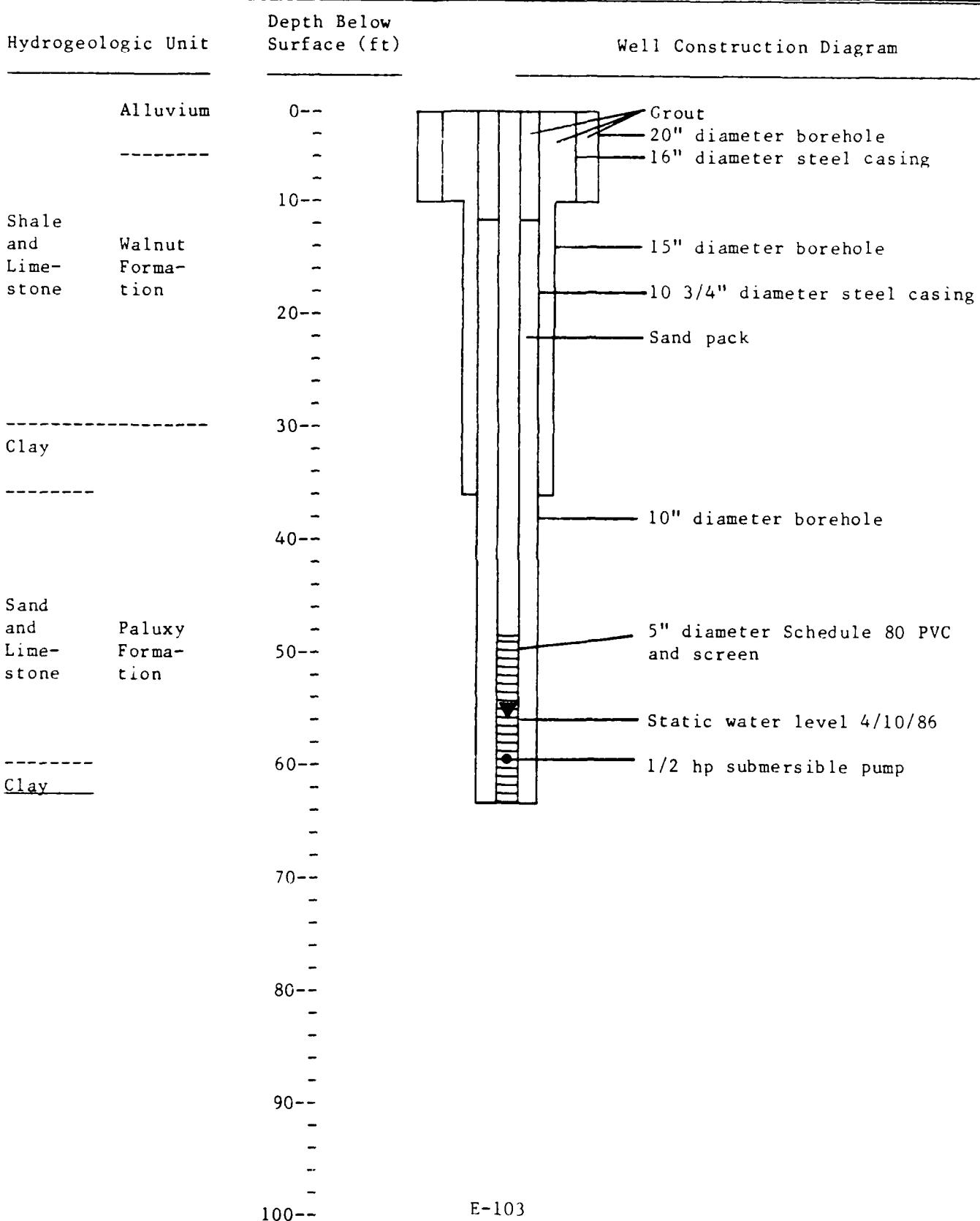
<u>Time</u>	<u>Clar/Clr.</u> <u>Discharge</u>	<u>Odor of</u> <u>Discharge</u>	<u>Lithology/</u> <u>Grain Size</u>	<u>pH</u>	<u>Conduc-</u> <u>tivity</u>	<u>Remarks</u>
1658	Turbid	None	Silt	-	-	Began air lift
1800	Clear	None	None	-	-	Turned off compressor

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MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-22u
Location Landfill No. 3

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus



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MONITOR WELL COMPLETION LOG: SHEET 1/3

Monitor Well No. P-23u
Location Lake Worth
Elevation (surface) _____
Elevation (measuring pt.) 626.92

Project Air Force Plant 4 IRP
Log Recorded By Toby K. Walters
Drilled By Underground Resource Mgmt.

CONSTRUCTION

Construction Started 3/11/86 Completed 3/18/86
Total Depth Drilled (ft) 55.3 Hole Diameter 15" (0-33.75'); and
Drilling Method Mud rotary 10" (33.75-55.3')
Problems Encountered During Drilling None
Water Source for Drilling and Completion Procedures Air Force Plant 4 potable supply

COMPLETION

Type of Completion Above ground
Top of Well Casing (ft) apx. 4" AGL Depth (ft) 55.3
Screen Interval (ft-ft) 35.3-55.3

Interval of Grout (ft-ft) 0-33.75 (10 3/4" casing); 0-10.3 (5" PVC casing)
Interval of Bentonite (ft-ft) NA
Interval of Sand Pack (ft-ft) 10.3-55.3

MATERIALS

Casing Type 10 3/4" (ID) steel surface; 5" (ID) Schedule 80 PVC
Screen Type 5" (ID) Schedule 80 PVC Slot Size 0.010
Method of Joining Casing/Screen Screw type joints

*Type of Grout Portland Cement Source Midlothian, TX
Type I, 94 lb. sacks Amount 18 sacks 150 gallons
Type of Sand Pack No. 1A Blastsand, 100 lb. Source TX Mining Co., Arlington, TX
sacks Amount 18 sacks
Lithology of Sand Pack Primarily quartz, minor orthoclase

SECURITY MEASURES

Description Locking box over well (1/4" thick) with 3 protective posts cemented
into surface, radially 3' from well.

COMMENTS

Drilled 0-33.75' with 15: bit, set 10 3/4" steel casing (0-33.75'), grout 0-23.75'.
Drilled out shoe, drill 10" hole (33.75-55.3), set 5" PVC casing (0-55.3'), sand pack
10.3-55.3', grout 0-10.3'.

*Materials for 5" PVC casing completion.

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MONITOR WELL COMPLETION LOG: SHEET 2/3

Boring or Well No. P-23u Project Air Force Plant 4 IRP
Location Lake Worth Log Recorded by Toby Walters

DEVELOPMENT

Development started 3/21/86 and ended 3/21/86.

Static water level before development 42.29 (ft) and after development 45 (ft).

Depth of open hole inside well before development 55.3 (ft) and after development 55.3 (ft).

Water quantity discharged during development 178 (ft³).

Type, size/capacity of pump or bailer used for development 1" tremmie line with air compressor capacity of well: 5 gpm

COMMENTS

BGL (below ground level); ID (internal diameter)

Development Record of Discharge and Sediment

Time	Clar/Clr. <u>Discharge</u>	Odor of <u>Discharge</u>	Lithology/ <u>Grain Size</u>	pH	Conduc- tivity	Remarks
0820	Turbid	None	Silt	-	-	Air lift
1000	Clear	None	-	-	-	Water clear, stopped development

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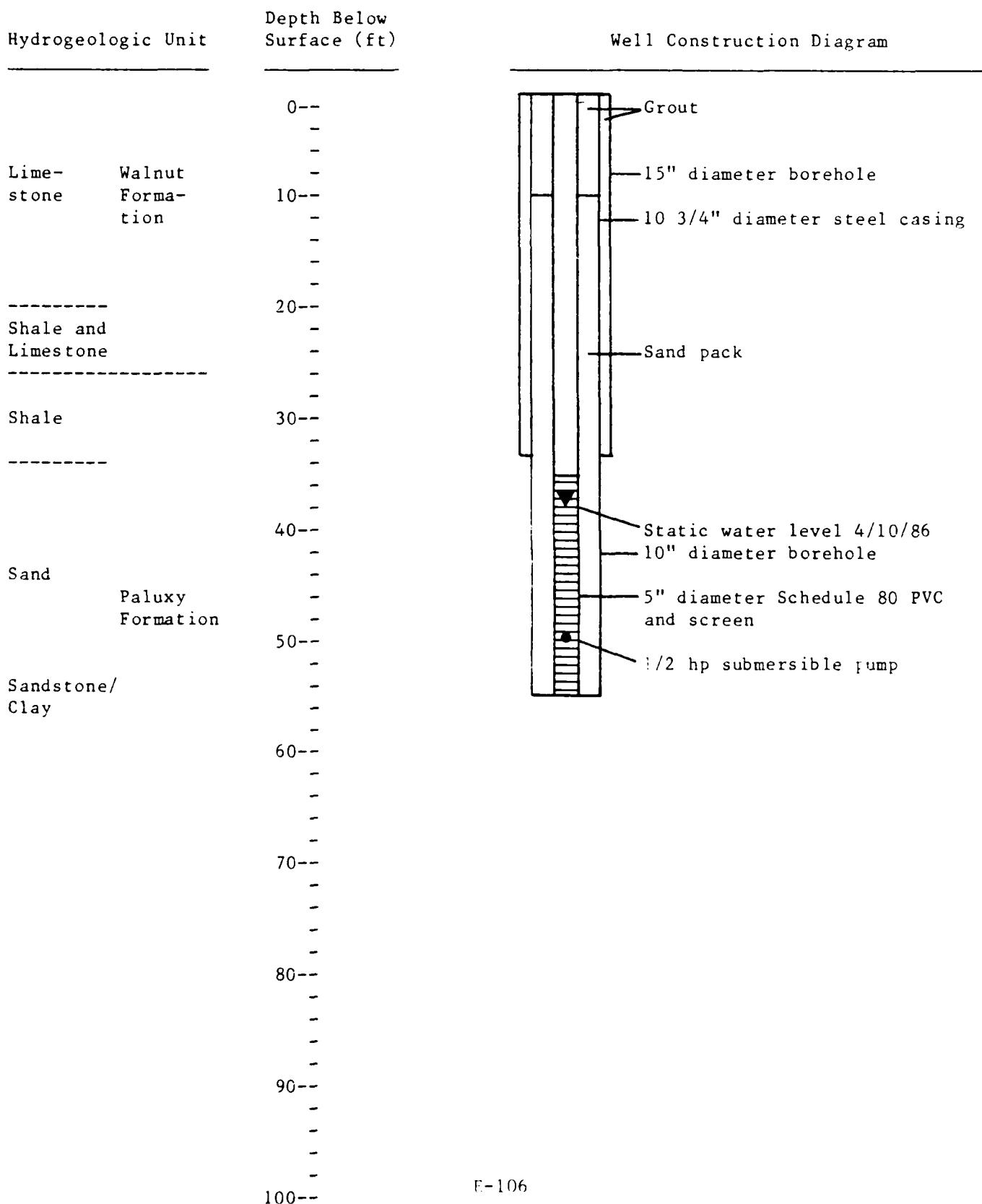
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-23u

Location Lake Worth

Project Air Force Plant 4 IRP

Log Recorded by Peter A. Waterreus





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